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THE UNIVERSITY OF ALBERTA

AN INVESTIGATION INTO THE
STRENGTH OF BOLTED JOINTS IN DOUGLAS FIR

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF
MASTER OF SCIENCE

DEPARTMENT OF CIVIL ENGINEERING

BY

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EDMONTON, ALBERTA

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SYNOPSIS

In an investigation into the effects of moisture content on the strength of bolted joints in Douglas fir, a total of sixty specimens were tested in compression. All specimens were identical with regard to number of bolts, bolt size, bolt spacing, end distance, edge distance and size of the individual wood pieces. In all specimens the grain in the side plates was parallel to the grain in the main member.

Results indicate that the strength of a bolted joint decreases with an increase in the moisture content. It appears that the modification factors for various seasoning conditions as given in the Canadian Standards Association Specification Number 086 - 1959 are conservative.

It was found that bolted joints which are seasoned after fabrication and in which the nuts are retightened after seasoning are as strong as joints fabricated from seasoned lumber. On the basis of the results of this investigation it is uncertain whether bolted joints which are seasoned after fabrication and in which the nuts are not retightened after seasoning are as strong as joints fabricated from seasoned lumber.

ACKNOWLEDGEMENTS

The author wishes to express appreciation for assistance he received from various sources.

The Canadian Institute of Timber Construction sponsored the investigation. Western Archrib Structures of Edmonton provided the materials and fabricated the test specimens. The United States Forest Products Laboratory provided some of the background literature and other valuable information.

Associate Professor J. Longworth helped greatly with his guidance throughout the course of the investigation and with his constructive criticism during the writing of the manuscript.

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INTRODUCTION

One of the problems which has restricted the use of wood construction is the difficulty in designing suitable connections between the members. This problem arises from the facts that wood has a relatively low crushing strength and the projected area of fasteners normally used is small. The development of timber connectors such as the split ring and shear plate has contributed much to the solution of this problem but has not completely solved it. With any type of connector it will often be found that the dimensions of the member are dictated by the space required to accomodate the necessary number and sizes of connectors (1).*

Bolts and timber connectors are the most commonly used fasteners in connections that carry sizeable computed loads (2). Bolted joints are simply fabricated, but as the allowable load per bolt is less than that for timber connectors their use may not be economical or practical. Because of spacing and edge distance requirements, it may sometimes be necessary to increase member sizes in order to accomodate the number needed. Timber connectors might then prove the preferable fastening if they permit the use of smaller size members. For fabrication in place or fabrication with all members laid in position (assembly fabrication), bolts have the advantage of simplicity as nothing more is required than the boring of a hole through two or more members and the insertion of the bolt. If members are prefabricated separately and then assembled, the labor advantage lies with the connectors because fewer units are

*Numbers in parenthesis refer to references listed at the end of this paper.

CHAPTER I

The first part of the book is devoted to a general survey of the subject. It begins with a definition of the term "philosophy" and a discussion of its history. The author then proceeds to a consideration of the various branches of philosophy, including metaphysics, epistemology, ethics, and political philosophy. In each of these branches, the author presents a brief overview of the main theories and arguments. The second part of the book is devoted to a more detailed examination of the philosophy of mind. It begins with a discussion of the nature of consciousness and the relationship between the mind and the body. The author then considers the various theories of the mind, including dualism, materialism, and functionalism. The third part of the book is devoted to a discussion of the philosophy of language. It begins with a consideration of the nature of language and the relationship between language and reality. The author then examines the various theories of language, including nominalism, realism, and pragmatism. The fourth part of the book is devoted to a discussion of the philosophy of science. It begins with a consideration of the nature of science and the relationship between science and philosophy. The author then examines the various theories of science, including empiricism, rationalism, and postmodernism. The fifth part of the book is devoted to a discussion of the philosophy of art. It begins with a consideration of the nature of art and the relationship between art and philosophy. The author then examines the various theories of art, including formalism, expressionism, and postmodernism. The sixth part of the book is devoted to a discussion of the philosophy of religion. It begins with a consideration of the nature of religion and the relationship between religion and philosophy. The author then examines the various theories of religion, including deism, theism, and atheism. The seventh part of the book is devoted to a discussion of the philosophy of law. It begins with a consideration of the nature of law and the relationship between law and philosophy. The author then examines the various theories of law, including natural law, legal positivism, and legal realism. The eighth part of the book is devoted to a discussion of the philosophy of education. It begins with a consideration of the nature of education and the relationship between education and philosophy. The author then examines the various theories of education, including humanism, behaviorism, and constructivism. The ninth part of the book is devoted to a discussion of the philosophy of politics. It begins with a consideration of the nature of politics and the relationship between politics and philosophy. The author then examines the various theories of politics, including liberalism, conservatism, and socialism. The tenth part of the book is devoted to a discussion of the philosophy of economics. It begins with a consideration of the nature of economics and the relationship between economics and philosophy. The author then examines the various theories of economics, including capitalism, socialism, and communism. The eleventh part of the book is devoted to a discussion of the philosophy of history. It begins with a consideration of the nature of history and the relationship between history and philosophy. The author then examines the various theories of history, including empiricism, rationalism, and postmodernism. The twelfth part of the book is devoted to a discussion of the philosophy of culture. It begins with a consideration of the nature of culture and the relationship between culture and philosophy. The author then examines the various theories of culture, including functionalism, structuralism, and postmodernism. The thirteenth part of the book is devoted to a discussion of the philosophy of society. It begins with a consideration of the nature of society and the relationship between society and philosophy. The author then examines the various theories of society, including functionalism, structuralism, and postmodernism. The fourteenth part of the book is devoted to a discussion of the philosophy of the individual. It begins with a consideration of the nature of the individual and the relationship between the individual and philosophy. The author then examines the various theories of the individual, including humanism, behaviorism, and postmodernism. The fifteenth part of the book is devoted to a discussion of the philosophy of the future. It begins with a consideration of the nature of the future and the relationship between the future and philosophy. The author then examines the various theories of the future, including determinism, indeterminism, and postmodernism.

required and the chance for misfits is thereby lessened.

An important factor in the action of bolted joints is the ratio of the length of the bolt in the main member to the diameter of the bolt. Tests have shown that there is a definite relationship between this L/D ratio and the proportional limit stress which is defined as the proportional limit load divided by the projected bearing area of the bolts in the joint (3). Except for small values of this L/D ratio, the bending strength of the bolt as well as the crushing strength of the wood is intimately associated with the proportional limit strength of the joint. The average proportional limit stress drops off gradually as the L/D ratio increases. However, beyond an L/D ratio of about 5.5 the rate of decrease of the average proportional limit stress is the same as the rate of increase of the L/D ratio. This means that for all L/D ratios greater than 5.5 the proportional limit load remains constant for a bolt of a given diameter.

The bearing value of the wood and consequently the allowable load on a bolted joint depends on the species of wood.

Specific gravity is a definite criterion of the strength of wood. It is affected by the rate of tree growth and the amount of summerwood present. Wood is composed of elongated cells cemented together by lignin. Since the specific gravity of the material composing the cell walls, or the wood substance, is about 1.54 regardless of the species, all species would be of the same specific gravity were it not for the variation in the size and arrangement

of the cell cavities. The specific gravity of the wood substance is therefore a definite index of strength properties (4).

Moisture content is another factor which greatly affects the strength of wood. Storage of moisture in green wood is partly due to absorption by the cell walls, and partly due to retention in the cell cavities as in a container. As wood dries, the cell walls do not give off moisture until the adjacent cavities are empty. The condition in which the cell walls are fully saturated and the cell cavities empty is known as the fiber saturation point. It varies from about twenty five to thirty five per cent moisture content for most of the commonly used species (2).

Increase in strength begins when the cell walls begin to lose moisture, that is, after the wood is dried to a moisture content below the fiber saturation point. Below the fiber saturation point most strength properties increase rapidly as drying progresses. This increased strength of dry over green wood is due to two causes:

- (1) Actual strengthening and stiffening of the cell walls as they dry out.
- (2) Increase in the compactness or the amount of wood substance in a given volume because of the shrinkage that accompanies drying below the fiber saturation point.

The various strength properties are not equally affected by changes in moisture content. Whereas some properties, such as

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the second is the fact that the

the third is the fact that the

the fourth is the fact that the

the fifth is the fact that the

the sixth is the fact that the

the seventh is the fact that the

the eighth is the fact that the

the ninth is the fact that the

the tenth is the fact that the

the eleventh is the fact that the

the twelfth is the fact that the

crushing strength and bending strength, increase greatly with decrease in moisture content, others, such as stiffness, change only moderately. Shock resistance, which may even show a slight decrease, is affected adversely because it depends upon pliability as well as strength. Although the drier wood will sustain a greater load, it will not deform as much as green wood before failure.

The increase in strength with seasoning is much greater in small, clear specimens of wood than in large timbers containing defects. In large members, the increase in strength is to a great extent offset by the influence of defects that develop in seasoning (2).

Another factor which affects the strength of a connection is its tightness. If any of the load on a connection is to be resisted by friction between the connected pieces the connection must be tight. Although friction does add some reserve strength to a joint it is variable and cannot be guaranteed. Some specifications require retightening of the bolts after a period of time in order to prevent "working" of the joints (5).

When a bolted joint is properly detailed, the spacings, end distances and edge distances should be sufficient to develop the full strength of each bolt. These requirements are stated in design codes in terms of the bolt diameter. For example, the National Design Specification for Stress-Grade Lumber and Its Fastenings contains the following requirements (all spacings and distances being measured from the center of the bolt)(6). For

parallel to the grain loading:

- (1) The minimum spacing of bolts in a row shall be four times the bolt diameter.
- (2) The spacing across the grain between rows of bolts is controlled by net section (tension members).
- (3) The end distance shall be:
 - (a) In tension, seven times the bolt diameter for softwoods and five times for hardwoods.
 - (b) In compression, four times the bolt diameter.
- (4) The edge distance shall be at least one and one half times the bolt diameter, except that for L/D ratios more than six, use one half the distance between rows of bolts.

The basis of present design of bolted joints is, to a large extent, founded on research conducted at the Forest Products Laboratory at Madison, Wisconsin during the 1930's (3). In a series of tests conducted for the determination of the bearing strength of wood under bolts of various diameters and lengths, specimens containing one bolt were tested. Some specimens were fabricated with metal side plates, others with wooden side plates; some were loaded parallel to the grain, other perpendicular to the grain. In a series of tests to determine the effect of shrinkage subsequent to assembly, specimens containing four bolts were used. In tests to determine the effect of end and edge distances and spacings, the

number of bolts in each specimen varied from one to eight.

Gauges were attached at each end of the bolt to measure slip in the specimen, and the load was applied at the rate of 0.026 inches per minute.

The bolts had a yield point of approximately 45,000 pounds per square inch and ranged in size from one quarter to one inch in diameter. The thickness of the main members ranged from two to twelve times the bolt diameter. The species of wood used included Douglas fir, southern pine, Sitka spruce, oak and maple. Specimens in all tests, except those used to determine the effect of shrinkage, were cut from seasoned material. The properties of the test specimens were determined from tests on small samples cut from each piece.

From these tests it was found that there existed a definite relationship between the proportional limit of the average bearing value of the wood and the L/D ratio of the bolt. The average bearing value of the wood may be expressed in terms of the ratio of the length of the bolt in the main member of a joint to the bolt diameter. Furthermore, the tests showed that this relationship exists regardless of the size of the bolt. That is, a 1/2 inch bolt in timber 4 inches thick will have the same average bearing value at the proportional limit as a 1 inch bolt in a timber 8 inches thick. This is true for loads parallel to the grain. However, when the load is applied perpendicular to the grain, it is necessary, within certain limits, to apply a correction factor depending upon the size of the bolt.

It was also found that the average proportional limit stress depended on whether the splice plates were made of wood or metal. The average proportional limit stress for a given L/D ratio for a joint with wood side plates was about 80% of that for a similar joint with metal side plates.

As has been stated previously, some joints were assembled from green material and allowed to season in air before testing in order to determine the effect of shrinkage. During seasoning the change in dimension across the grain is of considerable magnitude, although along the grain it is usually negligible. Because of the shrinkage across the grain, complications commonly arise from the use of green material in a bolted joint. In a joint in which the grain in the side plates is parallel to the grain in the main member, the effect of shrinkage is minimized. On the other hand, if relatively wide members are joined end to end with metal splice plates, splits are likely to develop at or near the bolts as a result of shrinkage. The same results are likely to occur if two or more members are bolted together in such a way that the grain of one piece is at right angles to that in the other pieces. If splits do develop, the loads are lowered as a consequence. The joints tested to determine the effects of seasoning were assembled in such a way that the grain of one piece was at right angles to that in the other piece. The L/D ratios ranged from 4 to 12. The proportional limit loads ranged from 25 to 40 per cent of what would normally be expected of the material at the time of test. The

maximum loads were approximately half of what would be expected had the material been allowed to season before assembly.

The allowable load given by specifications for joints fabricated from lumber at or above the fibre saturation point (25 to 35 per cent) has increased over the past few years. The National Design Specification for Stress-Grade Lumber and Its Fastenings (1944) states that the allowable bolt loads for lumber which becomes seasoned in place shall be one third of those for dry lumber (6). The 1952 edition of this specification gives a figure of 40%. The Canadian Standards Association gives modification factors as shown in the following table (7).

TABLE 1

Modification Factors for Seasoning and Service Conditions

<u>Moisture Content in Percent When Fabricated</u>	<u>Condition of Timber In Use</u>	<u>Modification Factor</u>
15	dry	1.00
20	dry	0.80
25	dry	0.60
30	dry	0.40

It is a well known fact that the strength of wood decreases as its moisture content increases but it would seem there is some doubt with regard to how great this reduction in strength is, and how much the increase in strength with drying is offset by the accompanying checking.

Consequently, in 1958 the Canadian Institute of Timber

Construction arranged a program of tests of bolted joints at the University of Alberta to determine the strength of joints seasoned after assembly. The results of this program of bolted joint tests are presented in this thesis.

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OBJECT AND SCOPE

The objects of the investigation presented in this thesis were:

- (1) To determine the strength of bolted joints seasoned after assembly.
- (2) To determine the effect of retightening the nuts on the bolts after the joints had seasoned.
- (3) To determine the reduction in strength due to a high moisture content.
- (4) To observe the initial slip in the joints.

Four groups of specimens were tested:

Group A specimens were fabricated from seasoned lumber and were tested within several days of fabrication.

Group B specimens were fabricated from green lumber and were tested within several days of fabrication.

Group C specimens were fabricated from green lumber and were then seasoned at room temperature and humidity for approximately three months. The nuts on the bolts were then retightened and the specimens were tested.

Group D specimens were fabricated from green lumber and were then seasoned at room temperature and humidity for approximately three months. The specimens were then tested without retightening of the nuts.

All specimens were identical with regard to number of bolts, bolt size, bolt spacing, end distance and edge distance. The

Section 1

Whereas the Government of the United States of America

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size of the individual pieces was the same throughout all the specimens.

The spacing, end distance and edge distance were selected according to the National Design Specification for Stress-Grade Lumber and its Fastenings (6).

MATERIALS AND FABRICATION OF SPECIMENS

In all, sixty specimens were fabricated in four groups of fifteen. All specimens were fabricated from clear Douglas fir (coastal region). This lumber was graded as dense, select structural grade. Lumber of this grade is recommended for engineered construction and for exposed interiors and exteriors where a combination of very high strength and finest appearance is required (8). This lumber is graded primarily for members stressed in bending, but may also be used as tension and compression members.

Characteristics and limiting provisions of this material are (8):

- (1) Splits, if present, must be very short.
- (2) Checks, if present, must be single, or if opposite each other they must have a sum total equal to a maximum of approximately one quarter the thickness.
- (3) Medium torn grain is allowed.
- (4) Skips, if present, must be occasional and small.
- (5) Medium pitch pockets are allowed.
- (6) Wane with a maximum of approximately one eighth of any face is allowed.
- (7) Knots, if present, must be sound, tight and well spaced.
- (8) Pitch streaks may be present.
- (9) Stained sapwood may be present.
- (10) Slope of grain in the middle one third of the length must not exceed one inch in twelve inches, the balance of the piece may be one inch in ten inches.
- (11) Close grain must be present.

THE HISTORY OF THE UNITED STATES

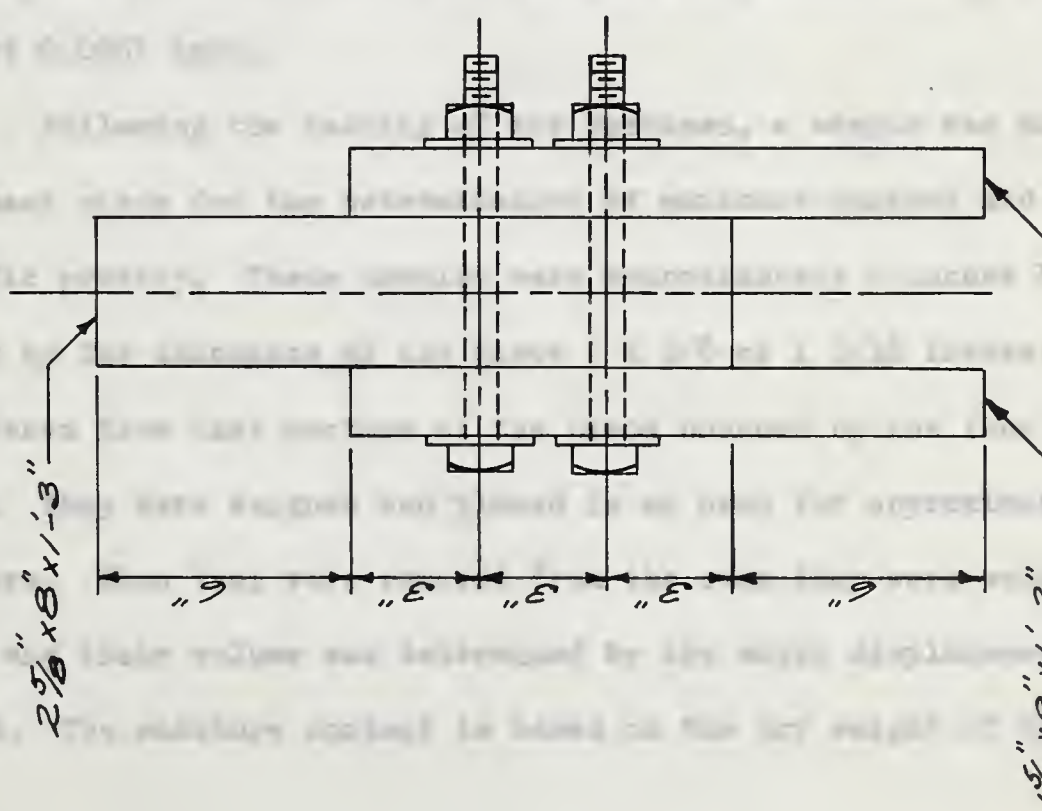
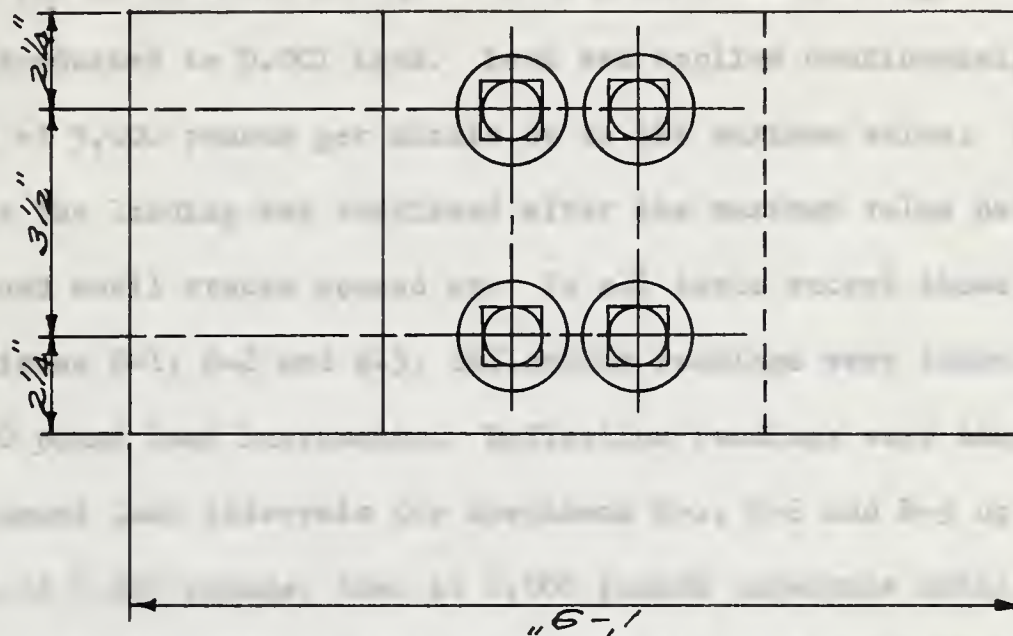
The history of the United States is a story of growth and change. It begins with the first settlers who came to the Americas in search of a new life. These early pioneers faced many hardships, but they persevered and built a new society. Over time, the United States grew from a small colony into a powerful nation. It fought wars, both with and without, and emerged as a global leader. The story of the United States is one of resilience and innovation, a testament to the human spirit.

The United States has a rich and diverse culture, shaped by the many different peoples who have called it home. From the Native Americans who lived on the land long before the first settlers, to the immigrants who came from all over the world, the United States is a melting pot of different traditions and customs. This diversity has been one of the strengths of the United States, allowing it to adapt and thrive in a constantly changing world. The United States has made many contributions to the world, from the invention of the automobile to the development of the internet. It has also been a leader in the fight for civil rights and social justice. The history of the United States is a story of progress and hope, a story that continues to inspire and guide us today.

"Dense Material" in Douglas fir averages approximately six or more annual rings per inch and, in addition, one third or more summerwood on either one end or the other of a piece. The contrast in color between the summerwood and springwood must be distinct. Pieces that average less than six annual rings per inch are accepted as dense if they average one half or more summerwood.

All lumber was planed on two sides and cut to the required lengths with a circular cut-off saw. The bolt-hole center lines were marked with a center punch according to a plywood template. The bolt-holes were then drilled in a hand fed drill press with a wood machine bit $13/16$ inch in diameter turning at 1,725 revolutions per minute. The bit had double cutters, extension lips and a center brad. Following this, the bolts were inserted in the holes and tightened until the washers began to bite into the wood. A torque wrench was not used. To ensure the ends of the specimen being parallel, the specimen was placed in another plywood template and the ends were trimmed with a band saw.

NOTE
ALL BOLTS $\frac{3}{4}" \phi$



TYPICAL SPECIMEN

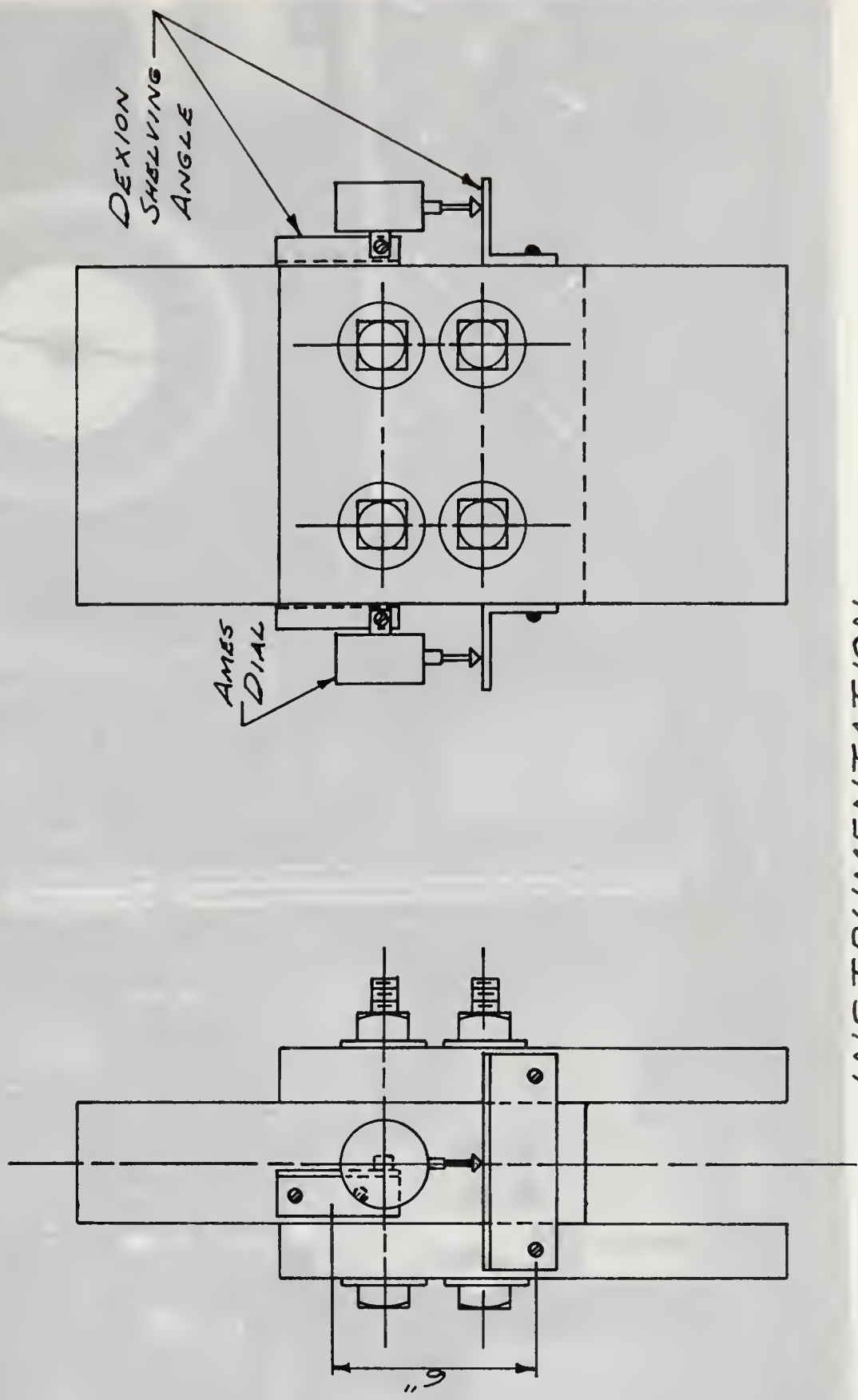
FIGURE 1
SCALE $\frac{3}{16}" = 1"$

Technical drawing of a mechanical assembly showing a cross-section of a shaft with a central hole and a flange. The drawing includes dimensions: 10 inches for the total length, 2 inches for the flange thickness, 2 inches for the hole diameter, and 2 inches for the flange width. The shaft is labeled "S2 x 3 x 13".

EXPERIMENTAL PROCEDURE

Specimens were tested in compression in a 200,000 pound capacity universal testing machine. Prior to testing, each specimen was fitted as shown in Figure 2 with Ames dials having 1 inch travel and graduated to 0.001 inch. Load was applied continuously at a rate of 5,000 pounds per minute up to the maximum value. In most cases the loading was continued after the maximum value had been reached until cracks opened up. In all tests except those for specimens B-1, B-2 and B-3, deflection readings were taken at 1,000 pound load increments. Deflection readings were taken at 500 pound load intervals for specimens B-1, B-2 and B-3 up to a load of 6,000 pounds; then at 2,000 pounds intervals until it was obvious by the rate of deflection that the load was nearing its ultimate value; and then at 1,000 pound intervals until the ultimate was reached. Ames dial readings were estimated to the nearest 0.0001 inch.

Following the testing of the specimen, a sample was cut from each piece for the determination of moisture content and specific gravity. These samples were approximately 2 inches by 2 inches by the thickness of the piece ($2 \frac{5}{8}$ or $1 \frac{5}{16}$ inches), and were taken from that portion of the piece bounded by the four bolt holes. They were weighed and placed in an oven for approximately 24 hours. When they were removed from the oven they were weighed again and their volume was determined by the water displacement method. The moisture content is based on the dry weight of the



INSTRUMENTATION

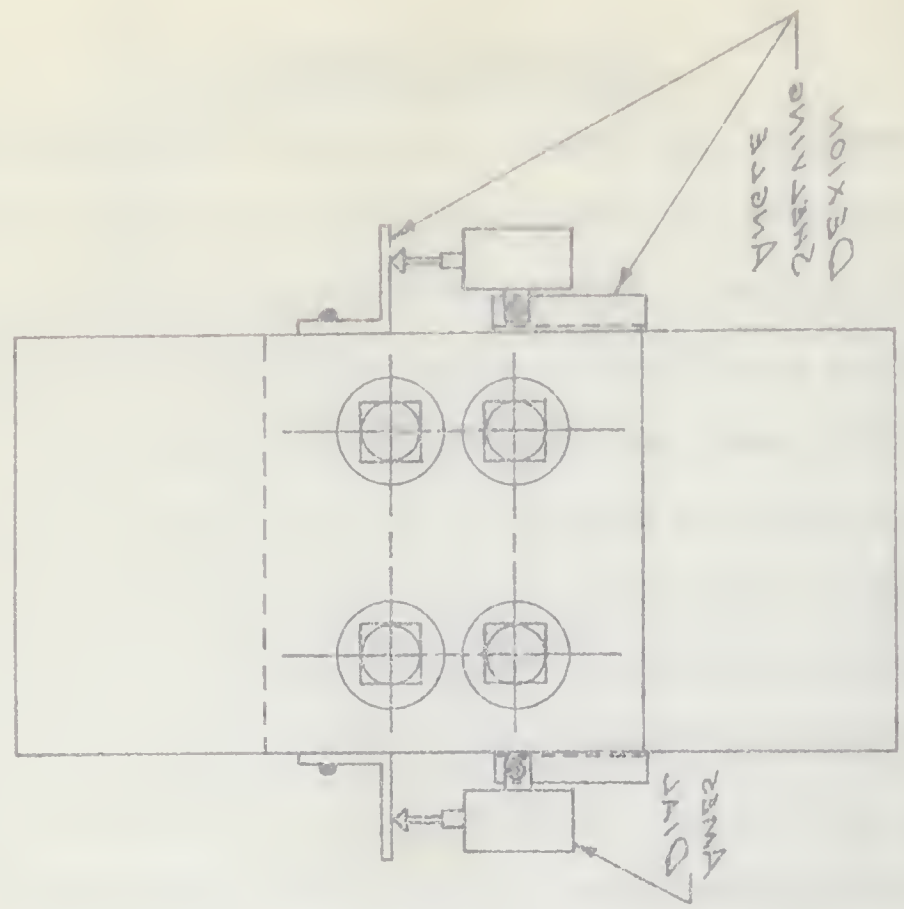
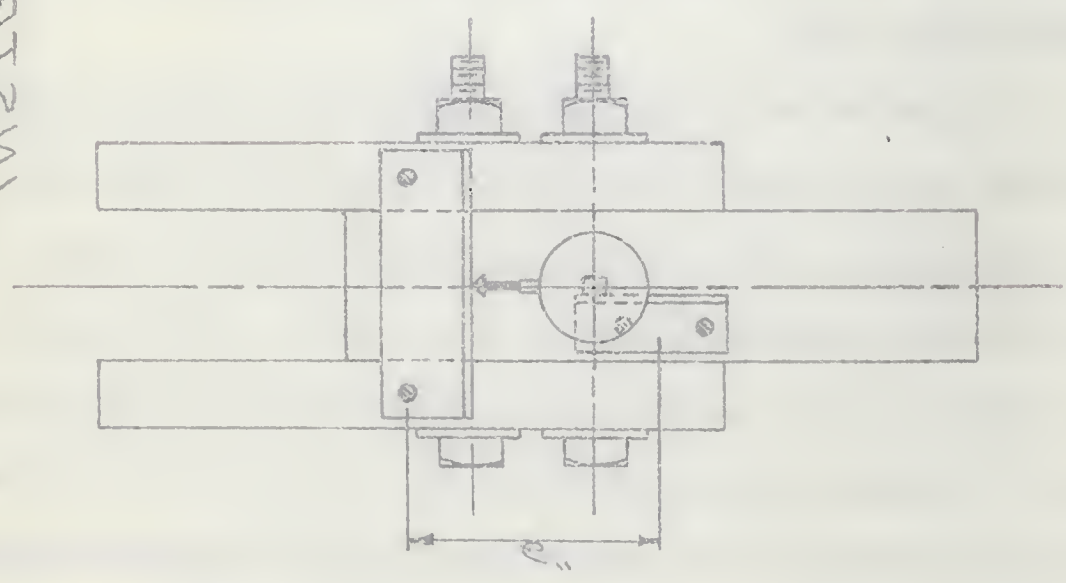
FIGURE 2

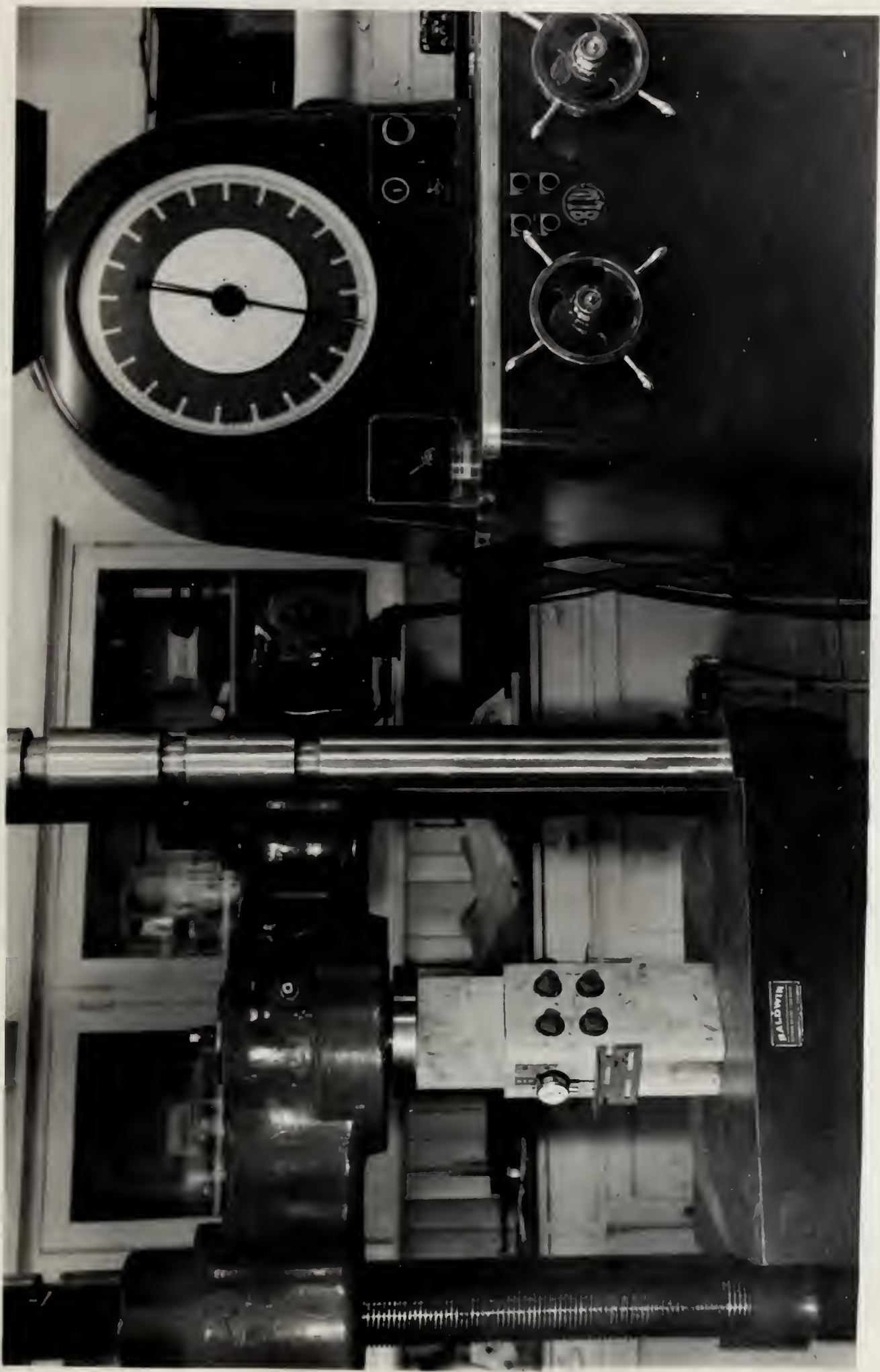
SCALE 3/16" = 1"

SCALE 1/8" = 1"

FIGURE 5

WATER TIGHTNESS





TESTING MACHINE WITH SPECIMEN IN PLACE

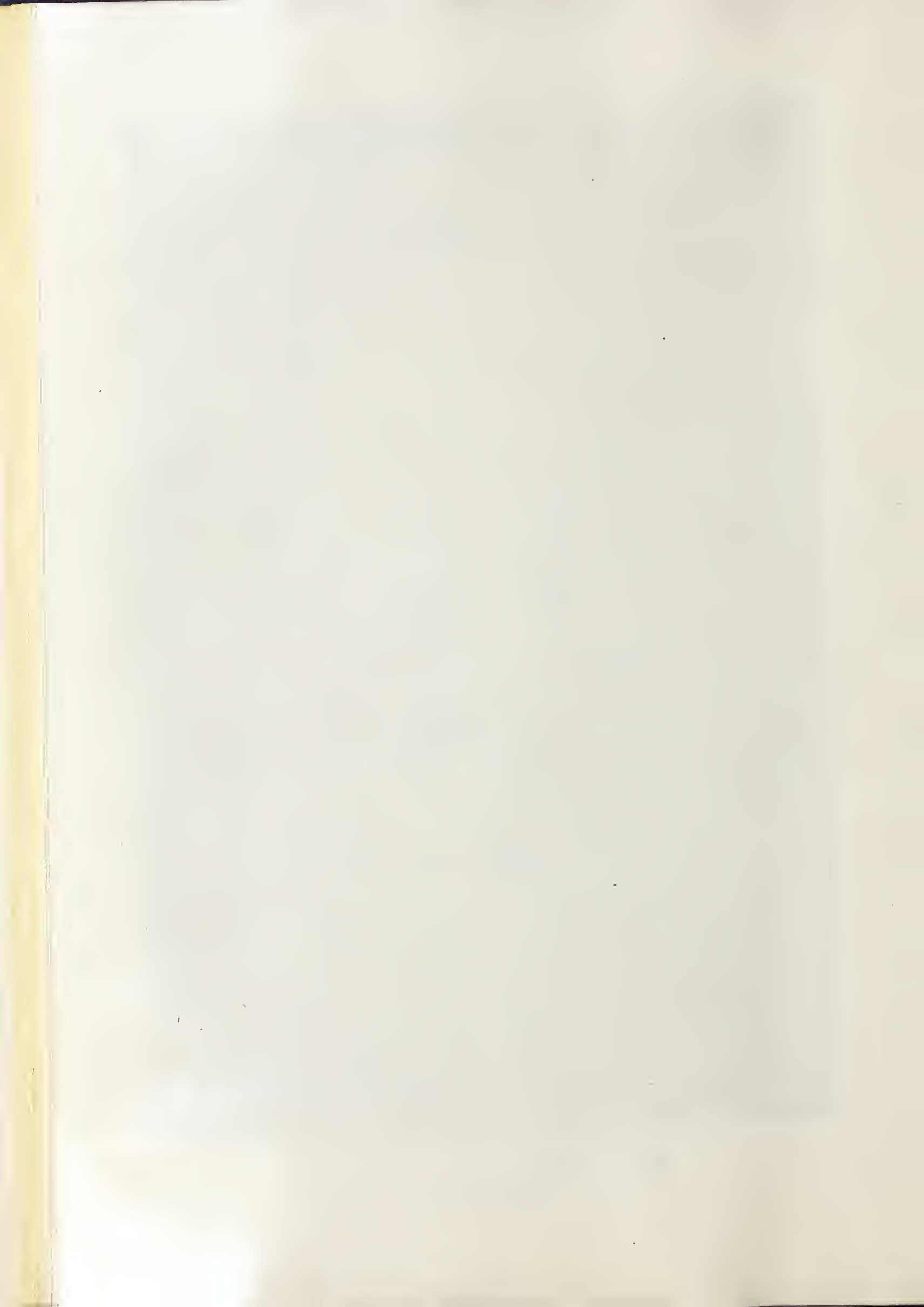
FIGURE 3





TYPICAL SPECIMEN IN TESTING MACHINE

FIGURE 4



sample. The specific gravity is based on the dry weight and the dry volume of the sample.

TEST RESULTS

Test results are presented as follows:

- (1) Load deflection curves.
- (2) Test results in tabular form.
- (3) Mean values of results for each series.
- (4) Photographs of specimens after testing.

FIGURE 5-1
LOAD DEFLECTION CURVES
JOINT SERIES A

A-1

PROP. LIMIT 21,000 LB.
ULT. LOAD 38,650 LB.

A-2

PROP. LIMIT 26,000 LB.
ULT. LOAD 35,550 LB.

A-3

PROP. LIMIT 27,000 LB.
ULT. LOAD 39,500 LB.

A-4

PROP. LIMIT 25,000 LB.
ULT. LOAD 37,950 LB.

50

40

30

20

10

0

LOAD IN KIPS

0 .1 .2 .3 .4 .5

DEFLECTION IN INCHES

FIGURE 5-2
LOAD DEFLECTION CURVES
JOINT SERIES A

A-5

PROP. LIMIT 21,000 LB.
ULT. LOAD 33,300 LB.

A-6

PROP. LIMIT 27,000 LB.
ULT. LOAD 39,800 LB.

A-7

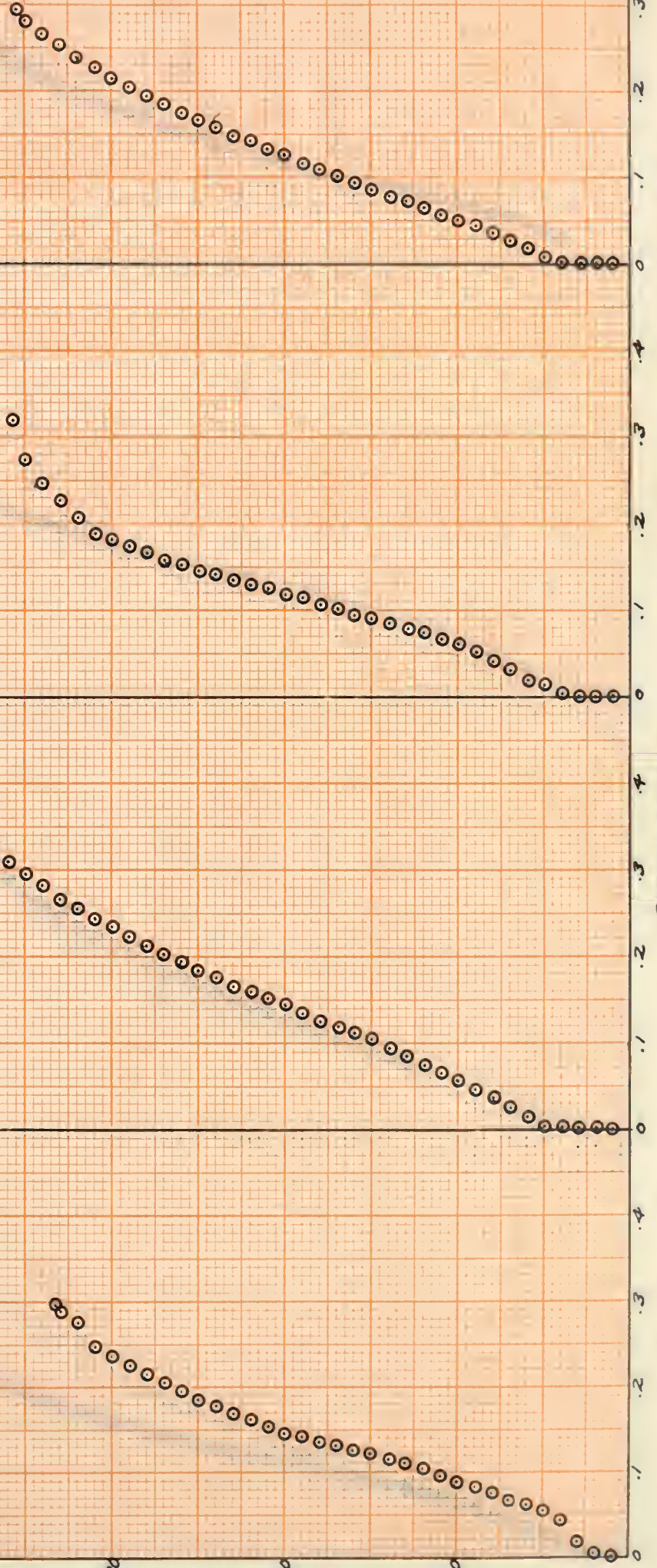
PROP. LIMIT 27,000 LB.
ULT. LOAD 35,700 LB.

A-8

PROP. LIMIT 27,000 LB.
ULT. LOAD 35,550 LB.

LOAD IN KIPS

DEFLECTION IN INCHES



2-1
 1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

2-2
 1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

2-3
 1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

2-4
 1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

1000 ft. - 1000 ft.
 1000 ft. - 1000 ft.

FIGURE 5-3
LOAD DEFLECTION CURVES
JOINT SERIES A

A-9

PROP. LIMIT 29,000 LB.
ULT. LOAD 43,500 LB.

A-10

PROP. LIMIT 26,000 LB.
ULT. LOAD 39,250 LB.

A-11

PROP. LIMIT 29,000 LB.
ULT. LOAD 48,700 LB.

A-12

PROP. LIMIT 27,000 LB.
ULT. LOAD 39,550 LB.

50

40

LOAD IN KIIPS

30

20

10

0

.1

.2

.3

.4

0

.1

.2

.3

.4

0

.1

.2

.3

.4

0

.1

.2

.3

.4

DEFLECTION IN INCHES

1. 1000
 2. 1000
 3. 1000
 4. 1000
 5. 1000
 6. 1000
 7. 1000
 8. 1000
 9. 1000
 10. 1000

1. 1000
 2. 1000
 3. 1000
 4. 1000
 5. 1000
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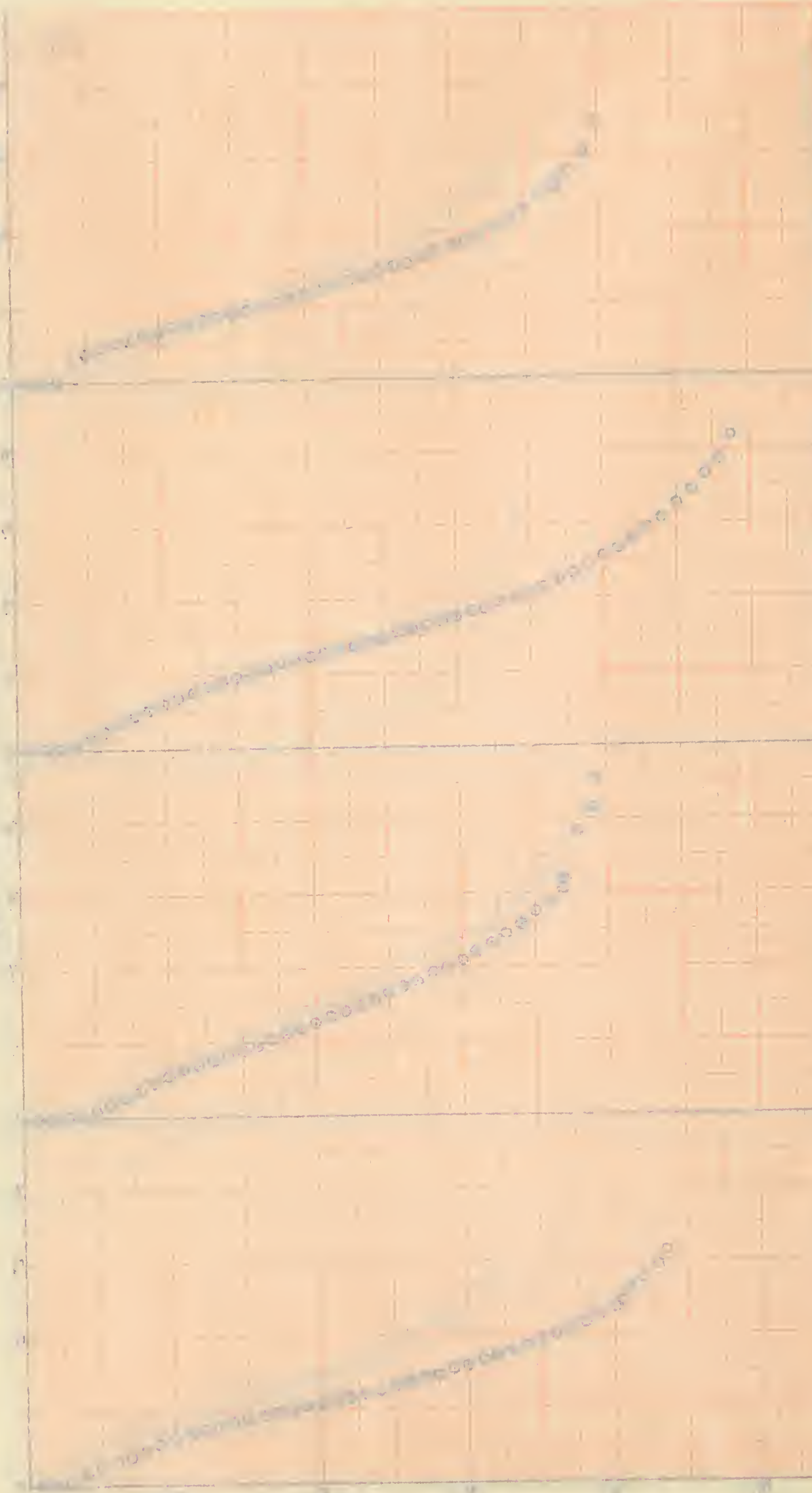


FIGURE 5-4
LOAD DEFLECTION CURVES
JOINT SERIES A

	A-13	A-14	A-15
PROP. LIMIT	25,000 LB.	27,000 LB.	25,000 LB.
ULT. LOAD	38,950 LB.	36,200 LB.	34,650 LB.

50

40

30

20

10

0

LOAD IN KIIPS

.1

.2

.3

.4

0

.1

.2

.3

.4

0

.1

.2

.3

.4

DEFLECTION IN INCHES

1. 100%
 2. 100%
 3. 100%
 4. 100%
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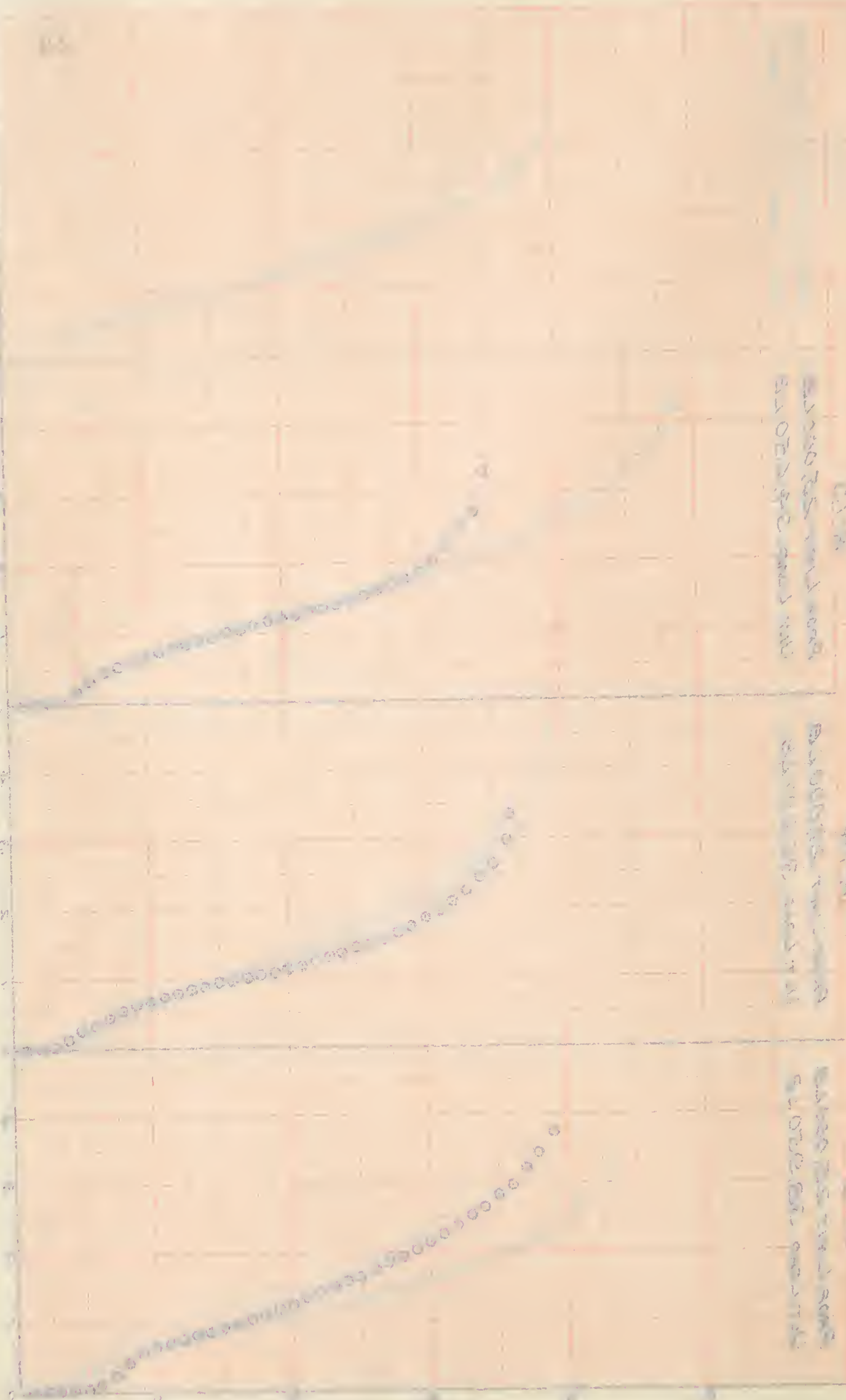


FIGURE 6-1
LOAD DEFLECTION CURVES
JOINT SERIES B

B-1

PROP. LIMIT 20,000 LB.
ULT. LOAD 38,750 LB.

B-2

PROP. LIMIT 20,000 LB.
ULT. LOAD 39,250 LB.

B-3

PROP. LIMIT 20,000 LB.
ULT. LOAD 37,850 LB.

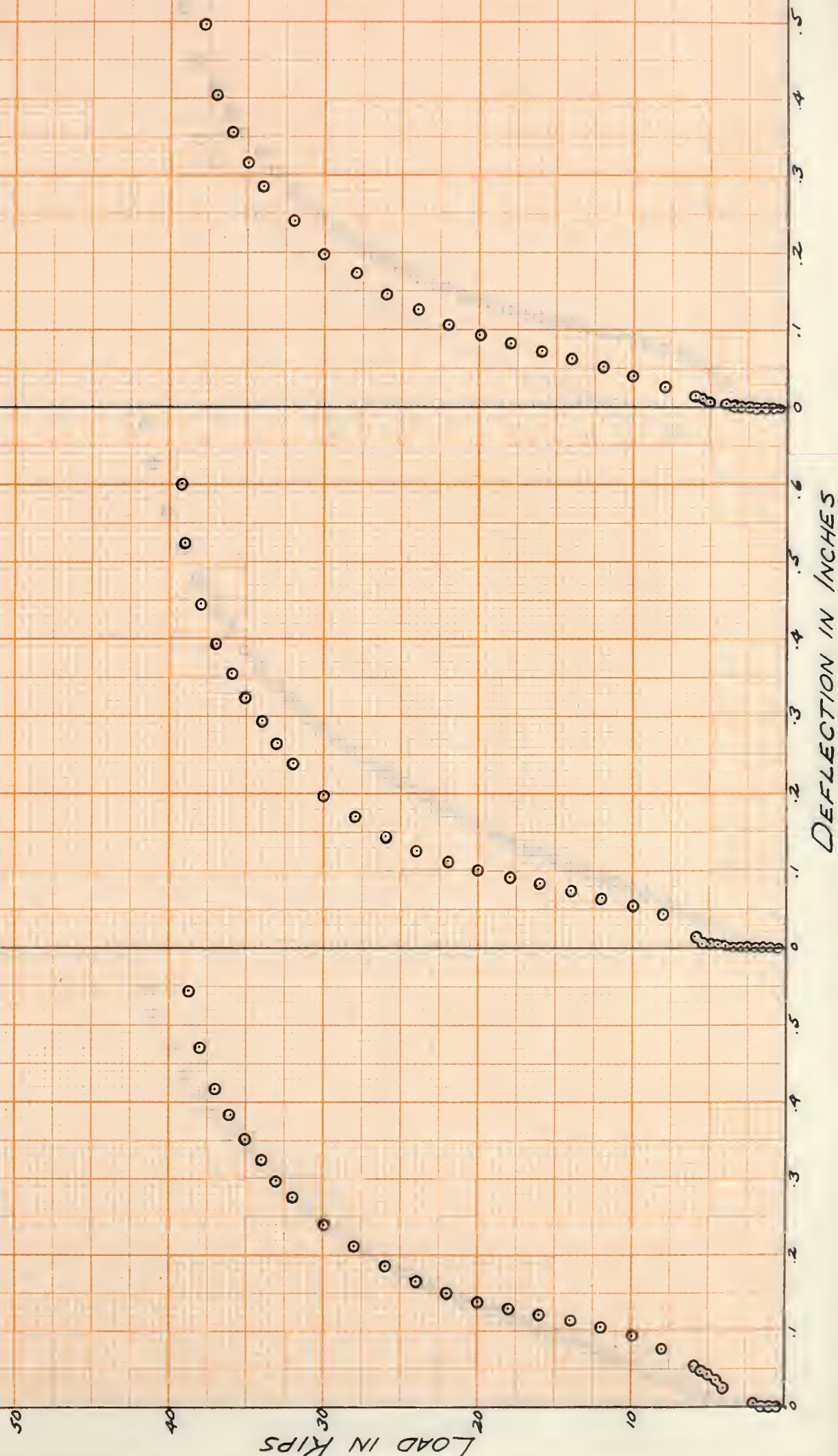


FIGURE 6-2
LOAD DEFLECTION CURVES
JOINT SERIES B

B-4

PROP. LIMIT 23,000 LB.
ULT. LOAD 41,250 LB.

B-5

PROP. LIMIT 16,000 LB.
ULT. LOAD 41,500 LB.

B-6

PROP. LIMIT 17,000 LB.
ULT. LOAD 38,950 LB.

50

40

30

20

10

0

LOAD IN KIPS

0

1

2

3

4

5

0

1

2

3

4

5

6

0

1

2

3

4

5

6

DEFLECTION IN INCHES

Deviation in degrees



Graph 1: Deviation in degrees vs. Distance in miles

Graph 2: Deviation in degrees vs. Distance in miles

Graph 3: Deviation in degrees vs. Distance in miles

Fig. 1

Fig. 2

Fig. 3

ANALYSIS OF THE DATA
FOR THE THREE CASES

FIGURE 6-3 LOAD DEFLECTION CURVES JOINT SERIES B

B-7

PROP. LIMIT 17,000 LB.
ULT. LOAD 39,000 LB.

B-8

PROP. LIMIT 20,000 LB.
ULT. LOAD 38,500 LB.

B-9

PROP. LIMIT 22,000 LB.
ULT. LOAD 41,650 LB.

50

40

30

20

10

0

LOAD IN KIIPS

DEFLECTION IN INCHES

TEMPERATURE IN °C



A

B

C

WATER VAPOR PRESSURE

WATER VAPOR PRESSURE

WATER VAPOR PRESSURE

WATER VAPOR PRESSURE

FIGURE 6-4
LOAD DEFLECTION CURVES
JOINT SERIES B

B-10

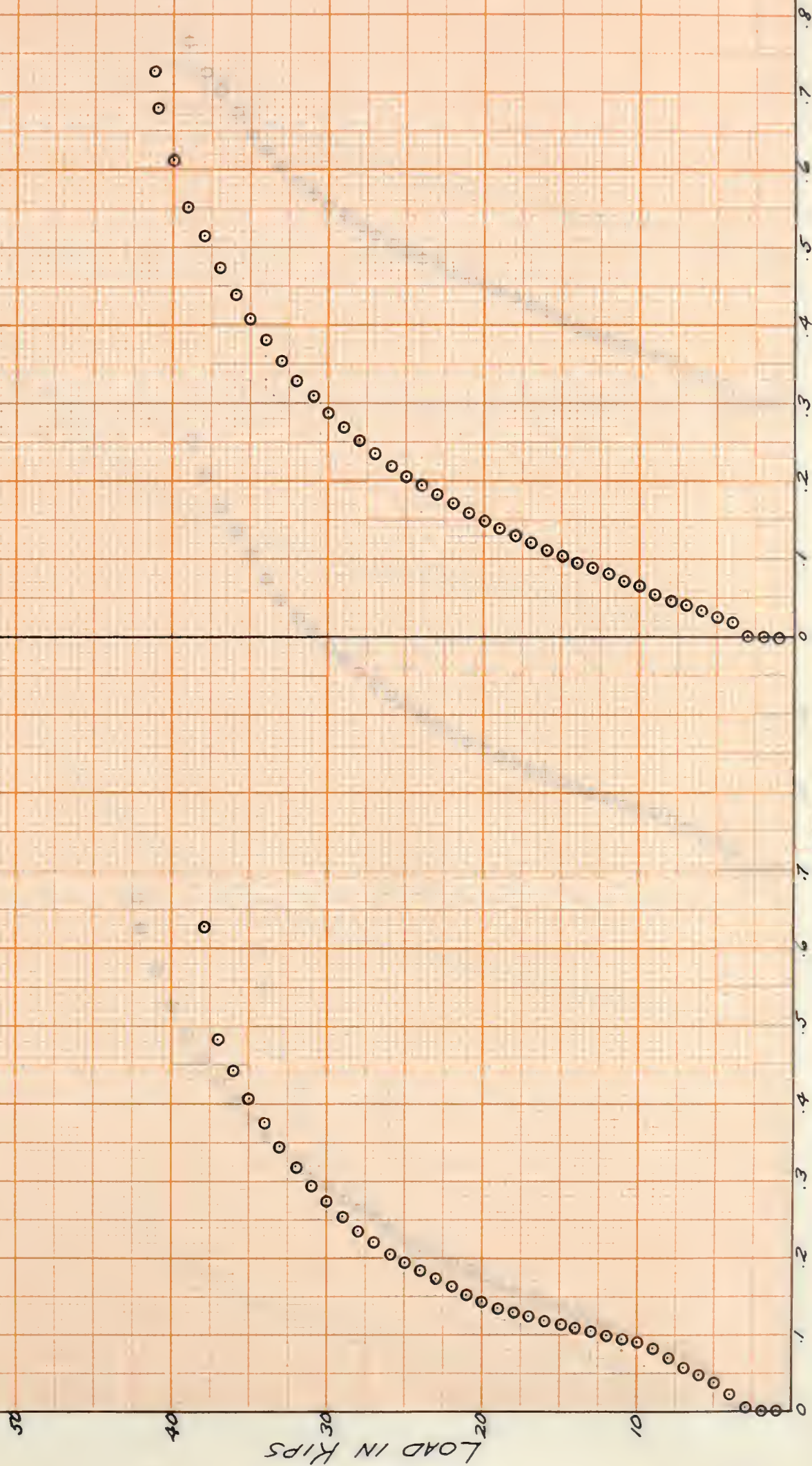
PROP. LIMIT 17,000 LB.

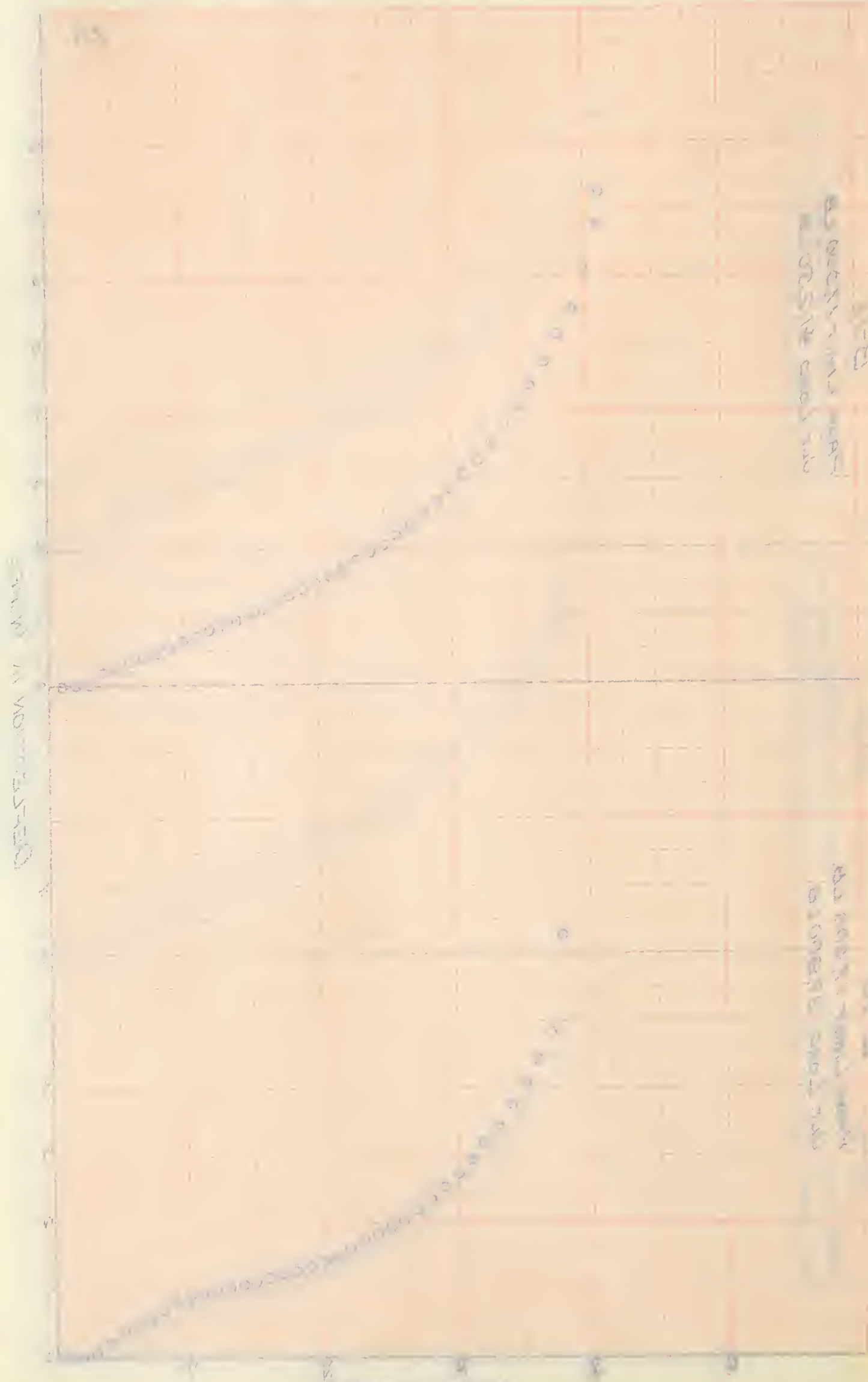
ULT. LOAD 37,900 LB.

B-11

PROP. LIMIT 17,000 LB.

ULT. LOAD 41,250 LB.





1st Curve
2nd Curve

1st Curve
2nd Curve

1st Curve
2nd Curve

FIGURE 6-5 LOAD DEFLECTION CURVES JOINT SERIES B

B-12

PROP. LIMIT 21,000 LB.
ULT. LOAD 42,100 LB.

B-13

PROP. LIMIT 16,000 LB.
ULT. LOAD 38,650 LB.

B-14

PROP. LIMIT 24,000 LB.
ULT. LOAD 40,000 LB.

50

40

30

20

10

0

LOAD IN KIIPS

0.6

0.5

0.4

0.3

0.2

0.1

0

0.5

0.4

0.3

0.2

0.1

0

0.6

0.5

0.4

0.3

0.2

0.1

0

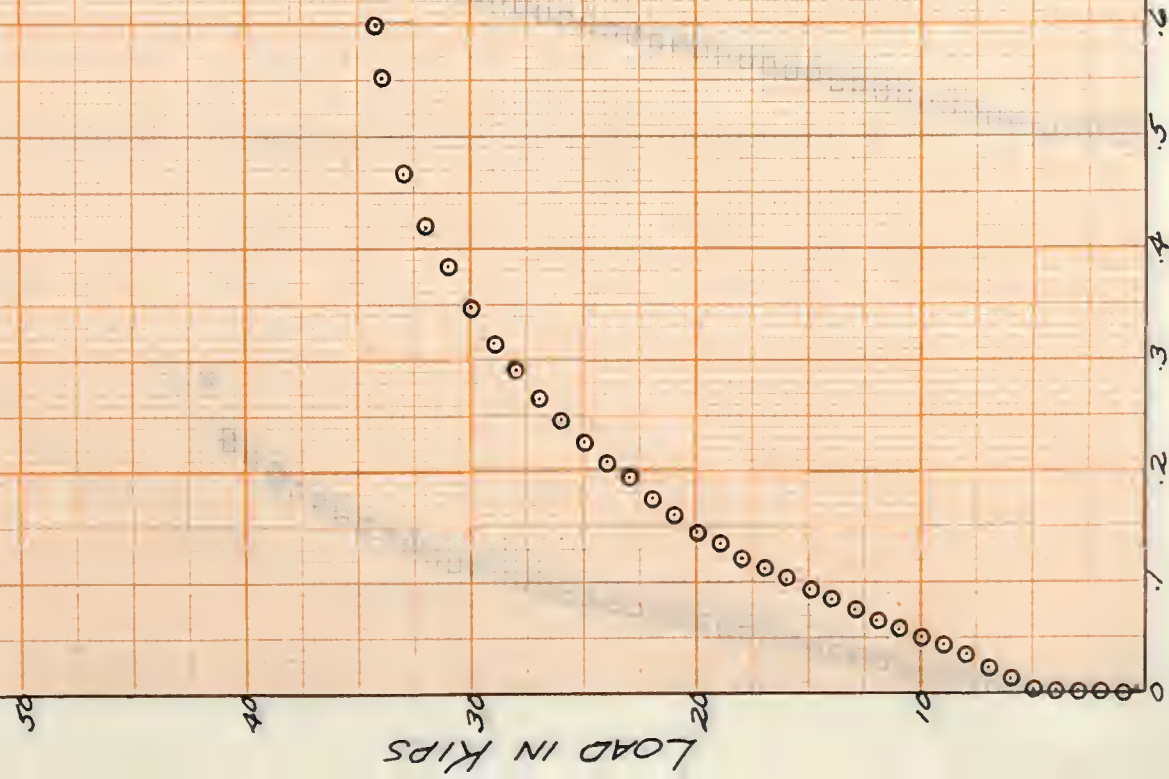
DEFLECTION IN INCHES

FIGURE 6-6 LOAD DEFLECTION CURVES JOINT SERIES B

B-15

PROP. LIMIT 17,000 LB.

ULT. LOAD 34,150 LB.

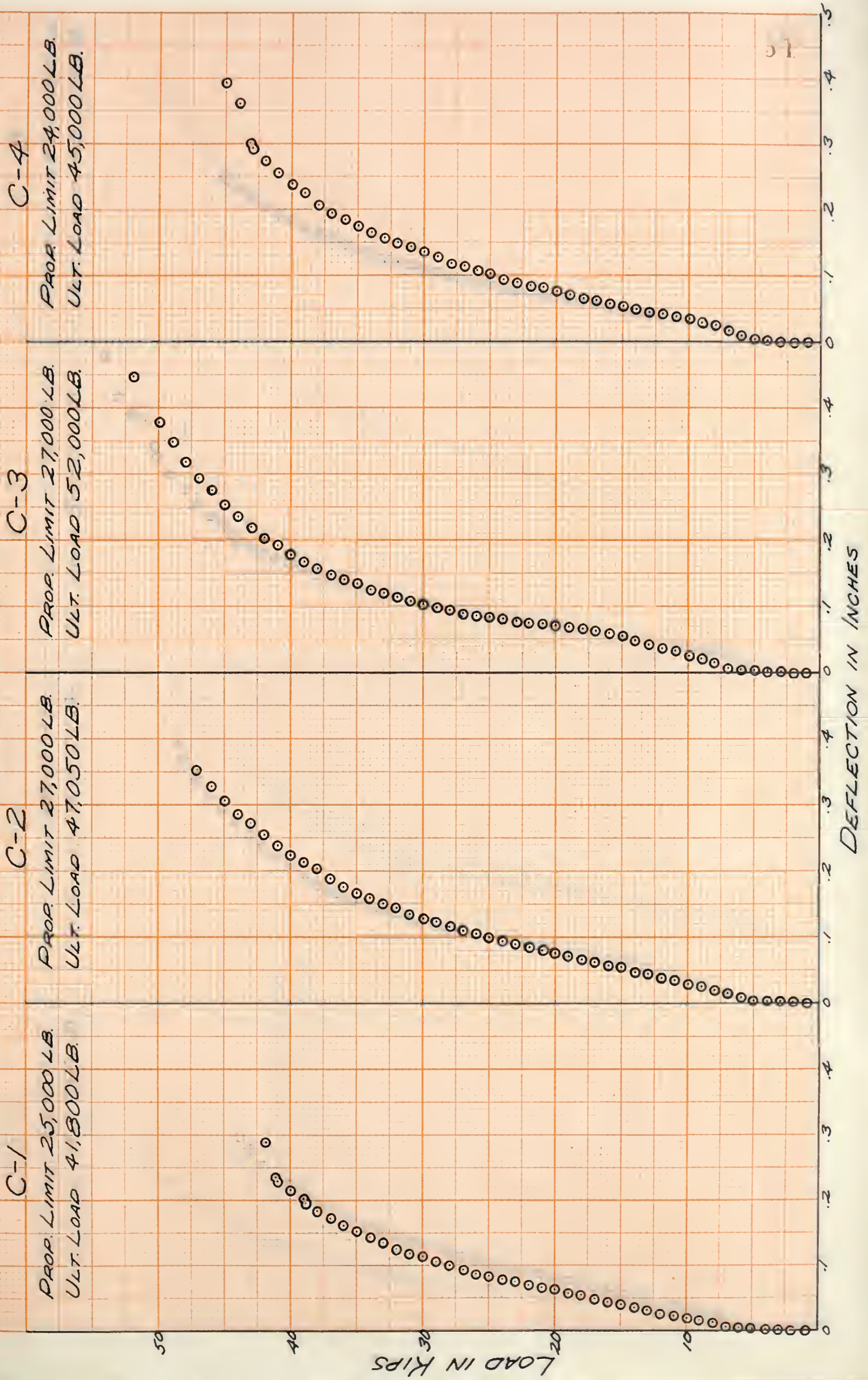


DEFLECTION IN INCHES

CONFECTION A FOUR



FIGURE 7-1
LOAD DEFLECTION CURVES
JOINT SERIES C



1801

10

1870

6

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FIGURE 7-2
LOAD DEFLECTION CURVES
JOINT SERIES C



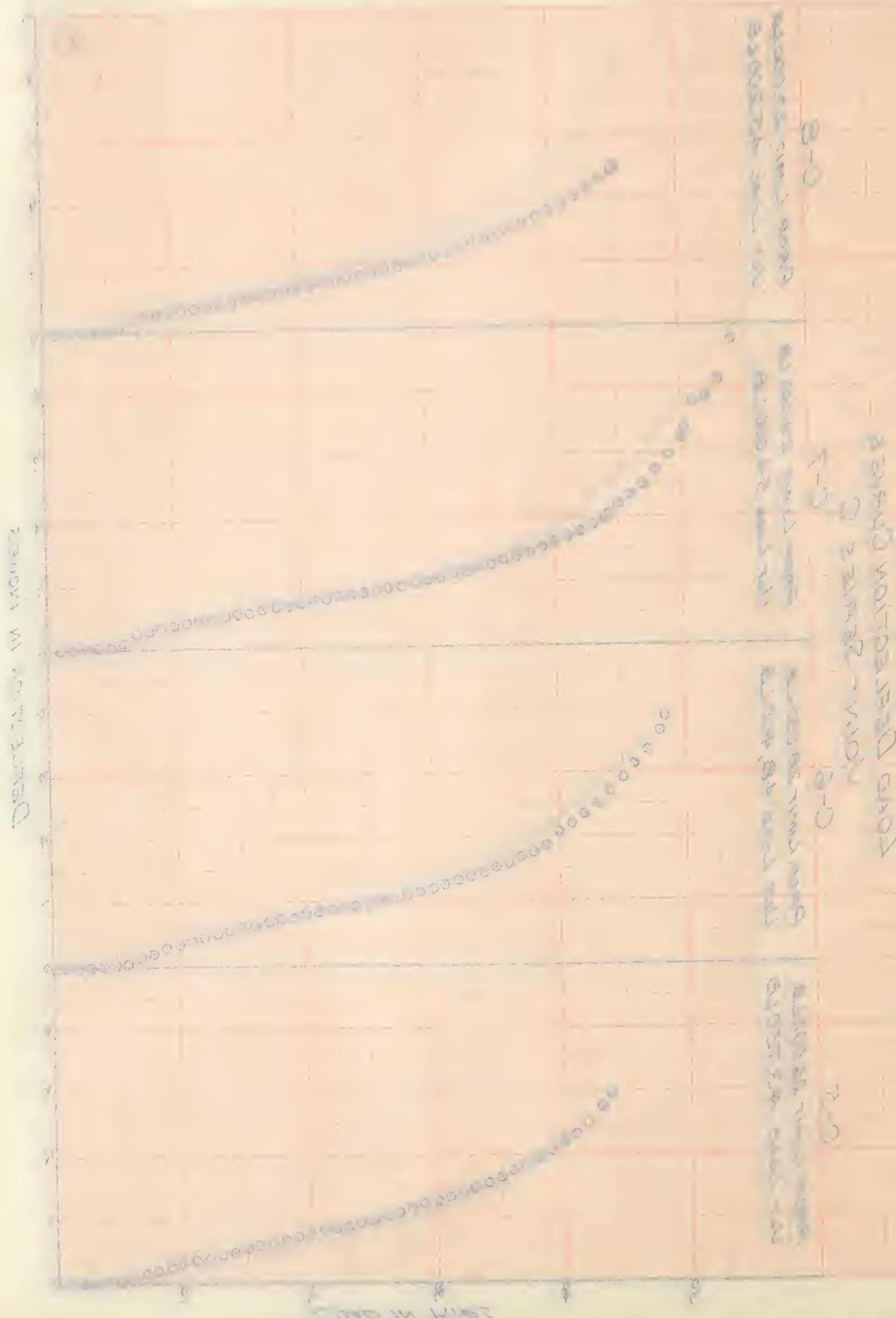
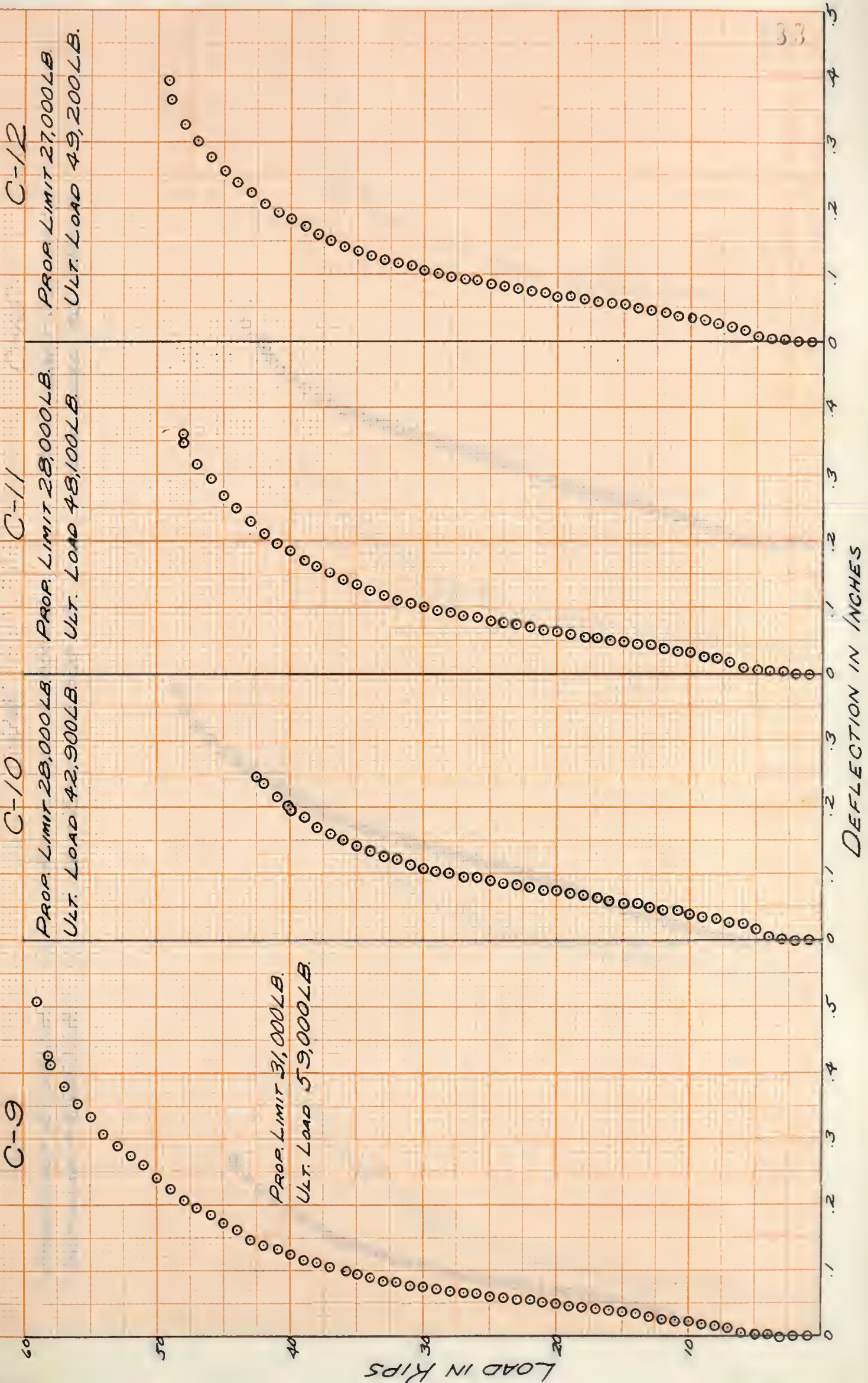


FIGURE 7-3
LOAD DEFLECTION CURVES
JOINT SERIES C



DEVELOPMENT IN YEARS



Development in Years
Time



Development in Years
Time



Development in Years
Time



Development in Years
Time

Time

Development in Years
Time

FIGURE 7-4
LOAD DEFLECTION CURVES
JOINT SERIES C

C-15

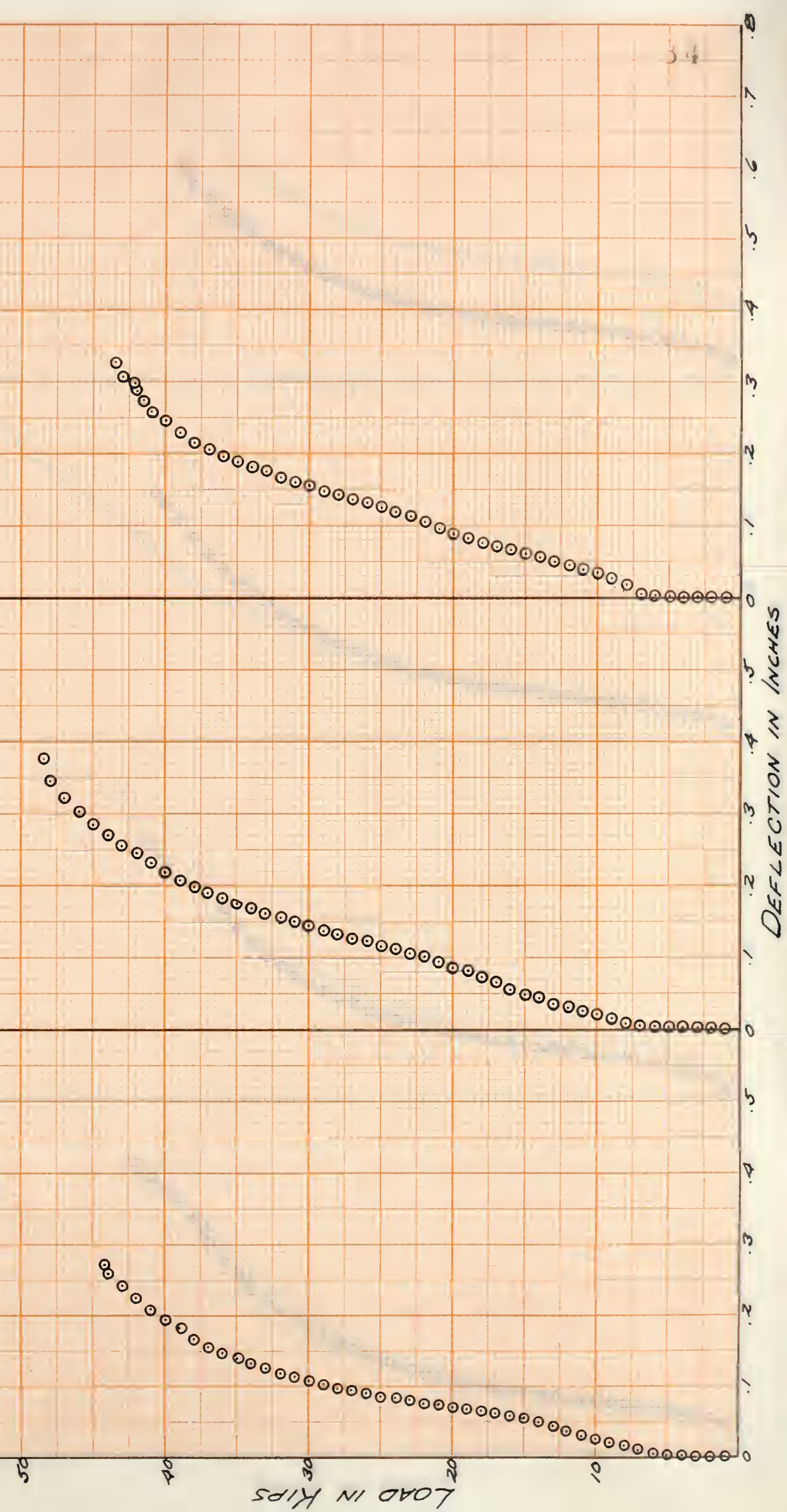
PROP. LIMIT 32,000 LB.
ULT. LOAD 43,500 LB.

C-14

PROP. LIMIT 32,000 LB.
ULT. LOAD 48,900 LB.

C-13

PROP. LIMIT 27,000 LB.
ULT. LOAD 44,250 LB.



Wavelength in cm



Curve 1
Wavelength in cm

Curve 2

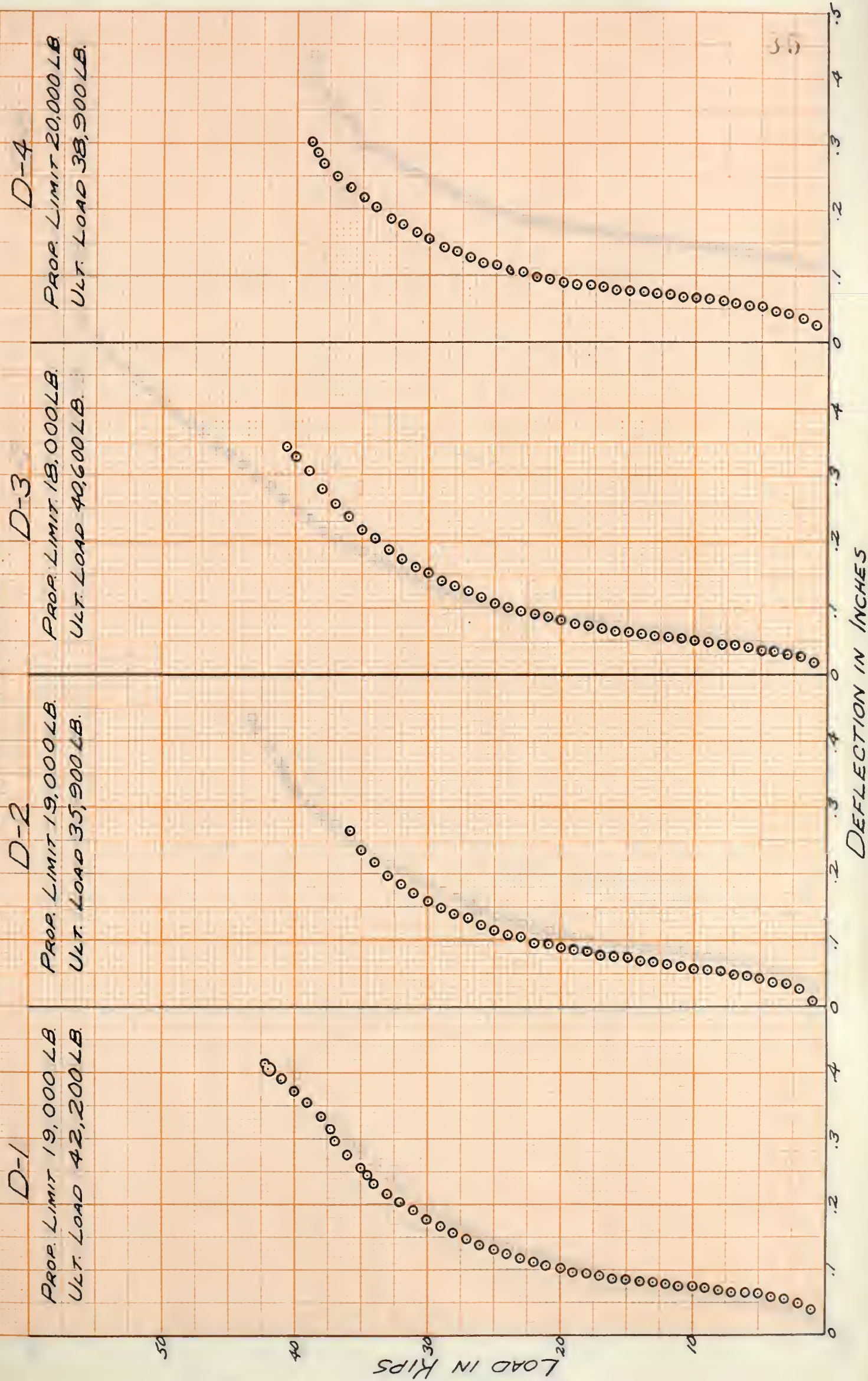
Curve 3
Wavelength in cm

Curve 4

Curve 5
Wavelength in cm

Curve 6

FIGURE B-1
LOAD DEFLECTION CURVES
JOINT SERIES D



STANDARDIZATION OF NaOH

NaOH
 0.1000 M NaOH
 10.00 mL NaOH

NaOH
 0.1000 M NaOH
 10.00 mL NaOH

NaOH
 0.1000 M NaOH
 10.00 mL NaOH

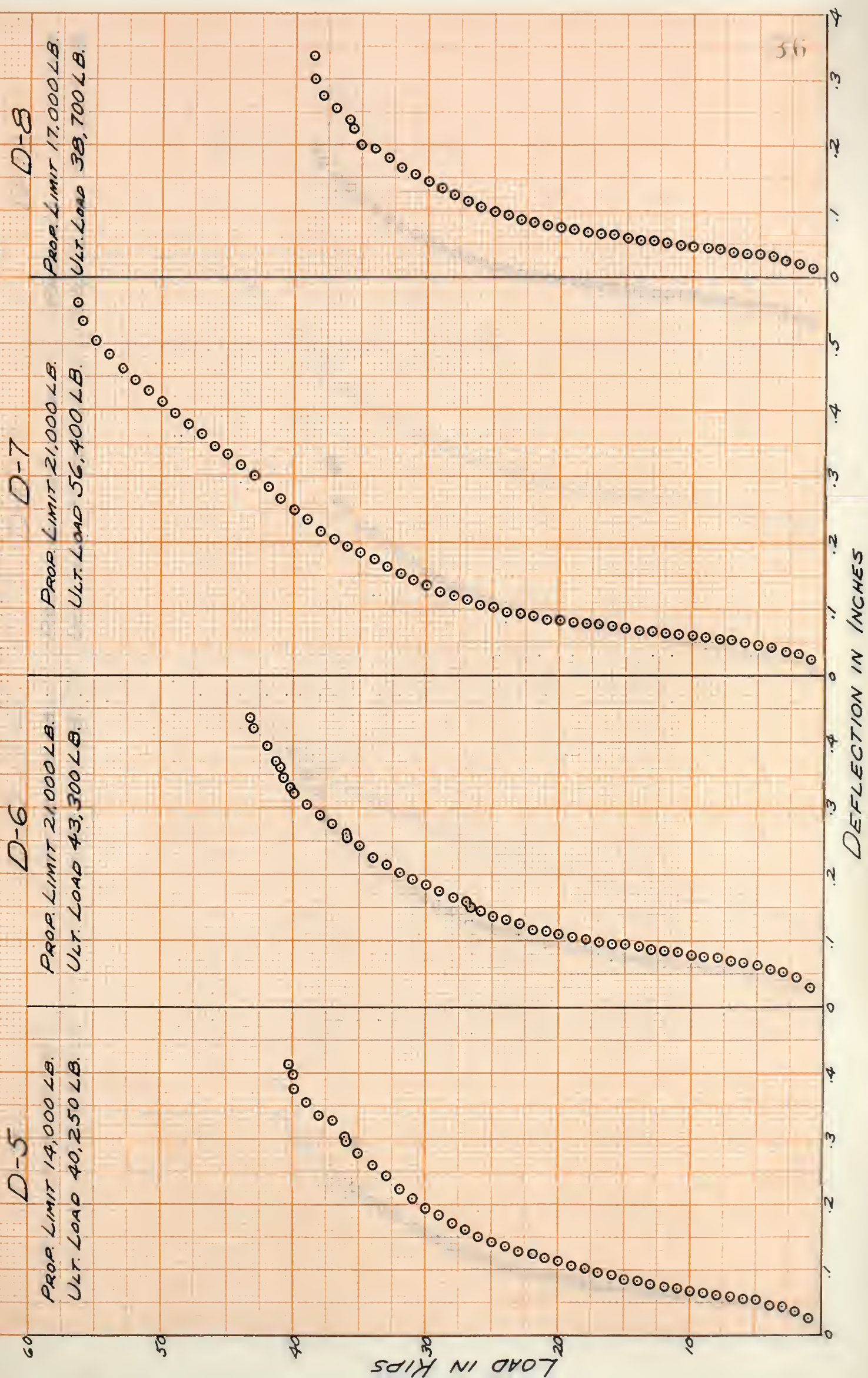
NaOH
 0.1000 M NaOH
 10.00 mL NaOH



Volume of NaOH

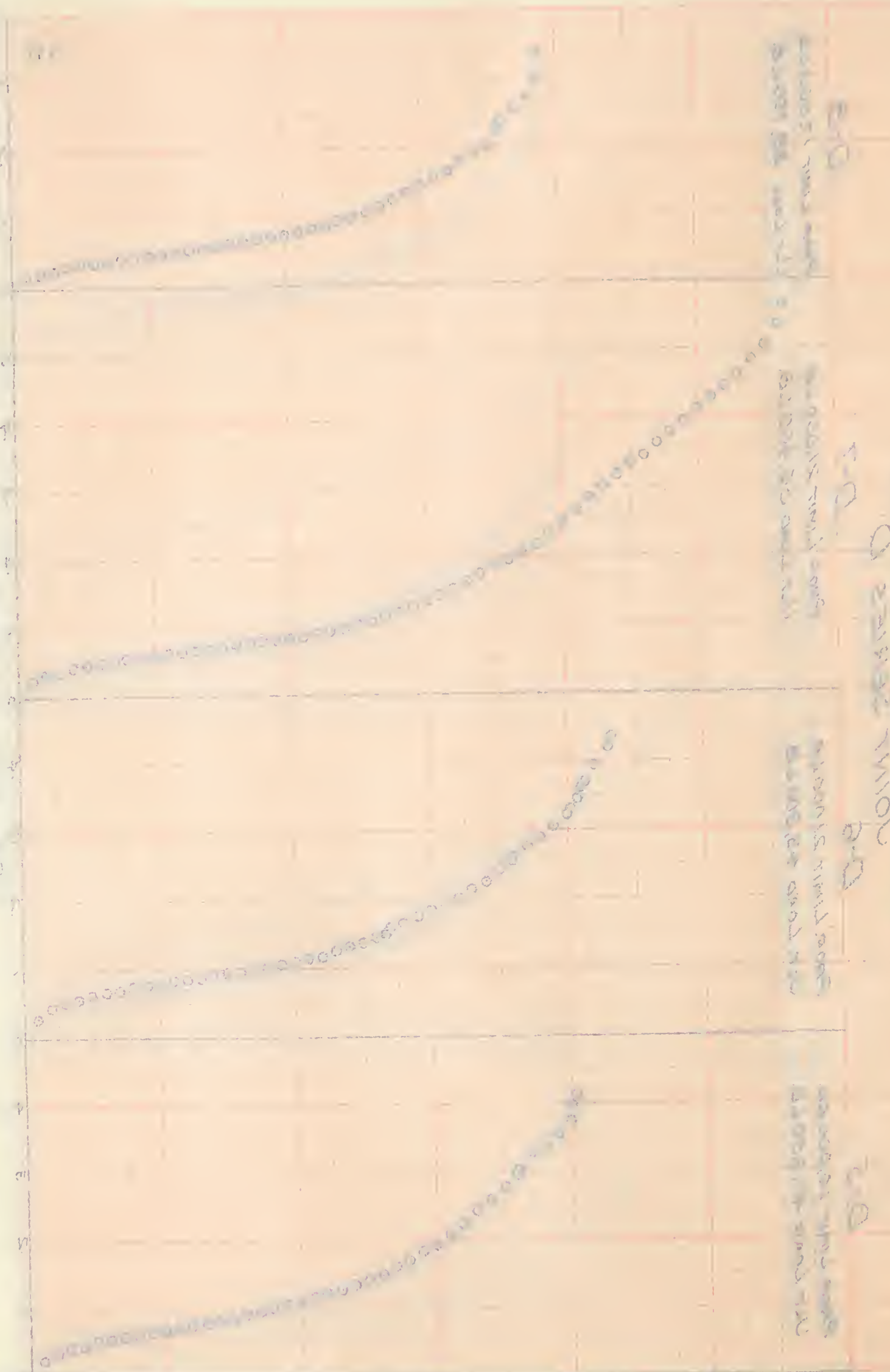
10

FIGURE 8-2
LOAD DEFLECTION CURVES
JOINT SERIES D



DEFLECTION IN INCHES

LOAD IN KILO



D-1
Simply supported beam with a point load at the center

D-2
Simply supported beam with a uniformly distributed load

D-3
Fixed-fixed beam with a point load at the center

D-4
Fixed-fixed beam with a uniformly distributed load

COMPARISON OF DEFLECTION CURVES

FIGURE B-3
LOAD DEFLECTION CURVES
JOINT SERIES D

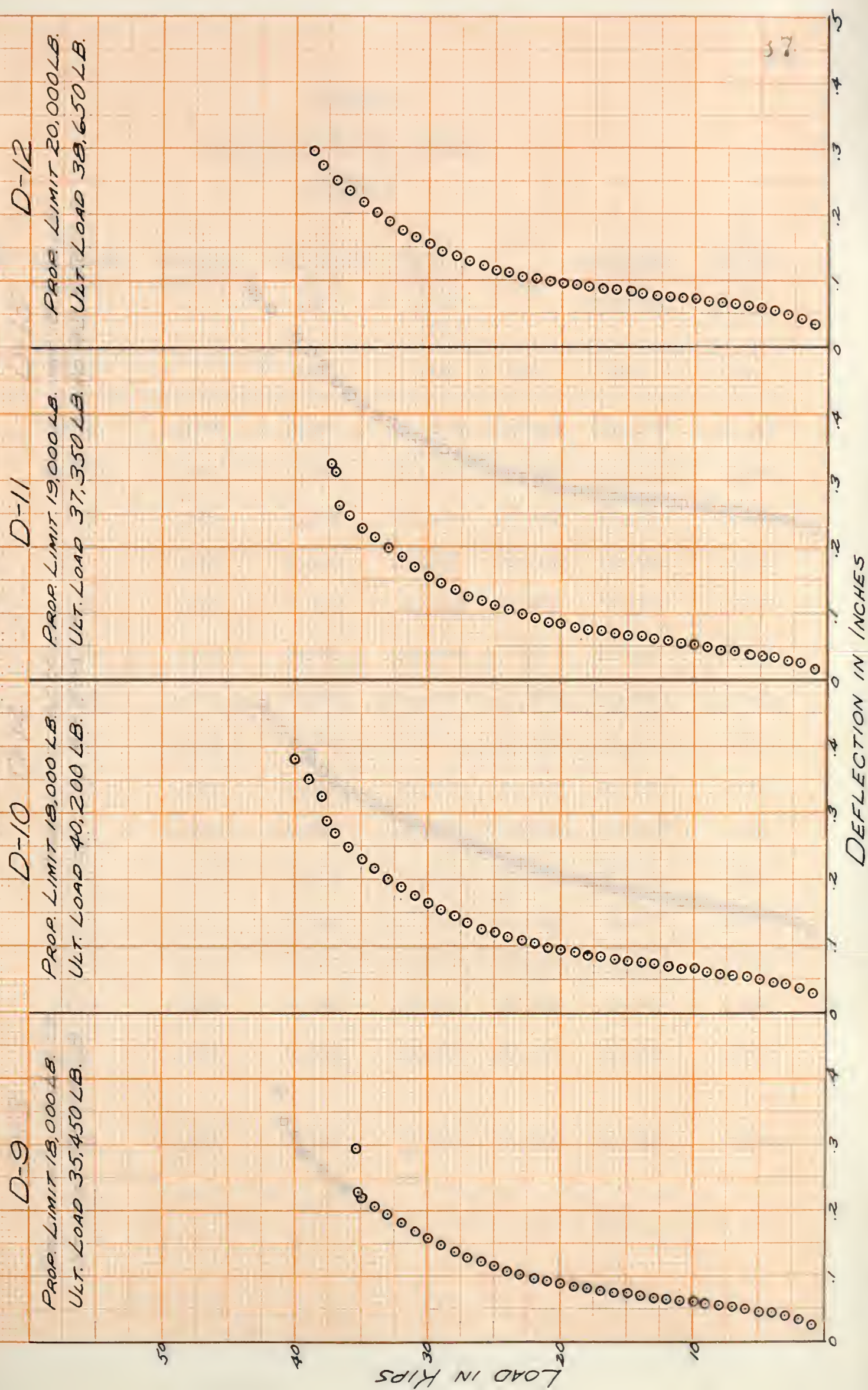


FIGURE B-4 LOAD DEFLECTION CURVES JOINT SERIES D

D-13

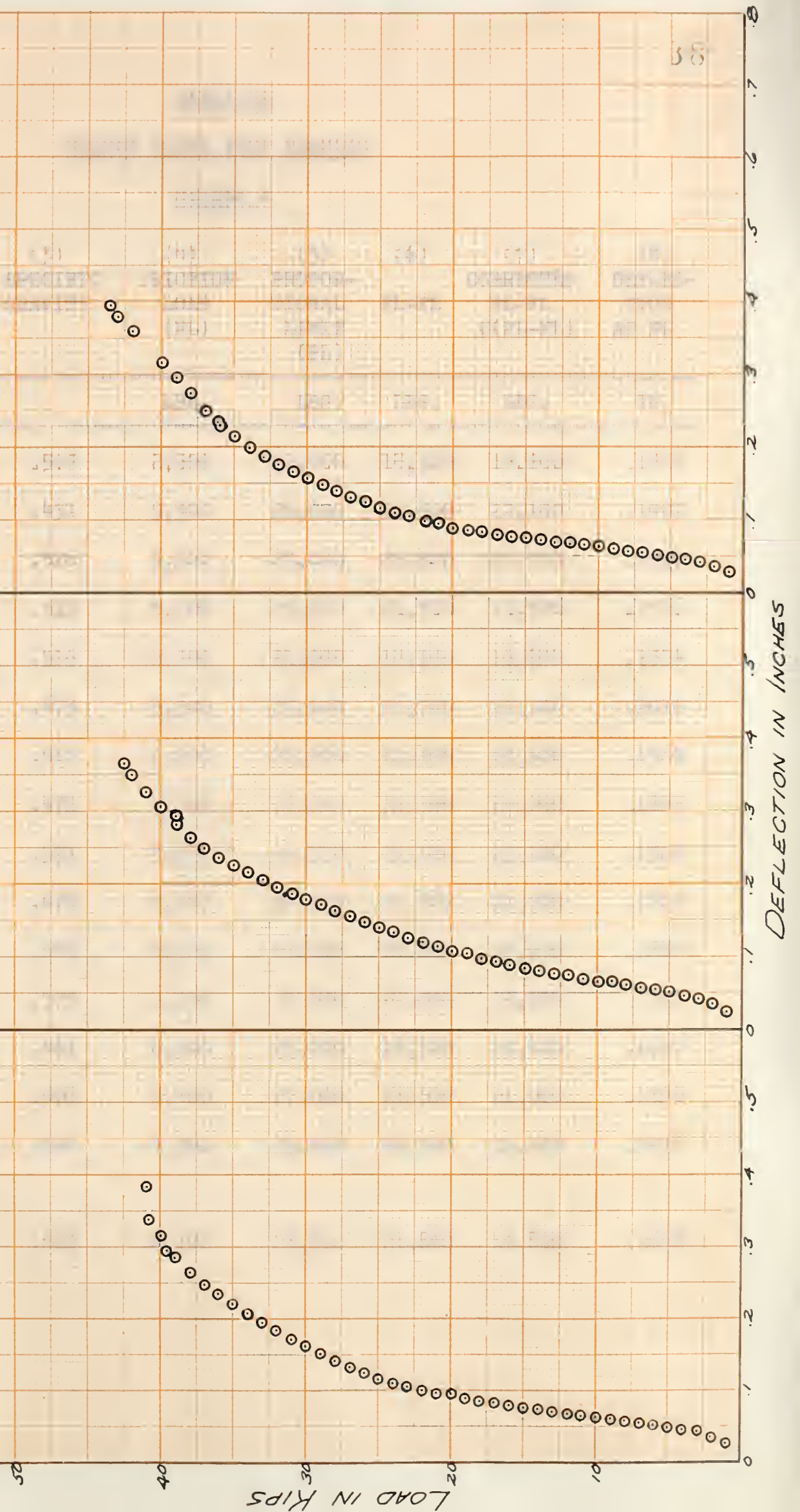
PROP. LIMIT 18,000 LB.
ULT. LOAD 41,000 LB.

D-14

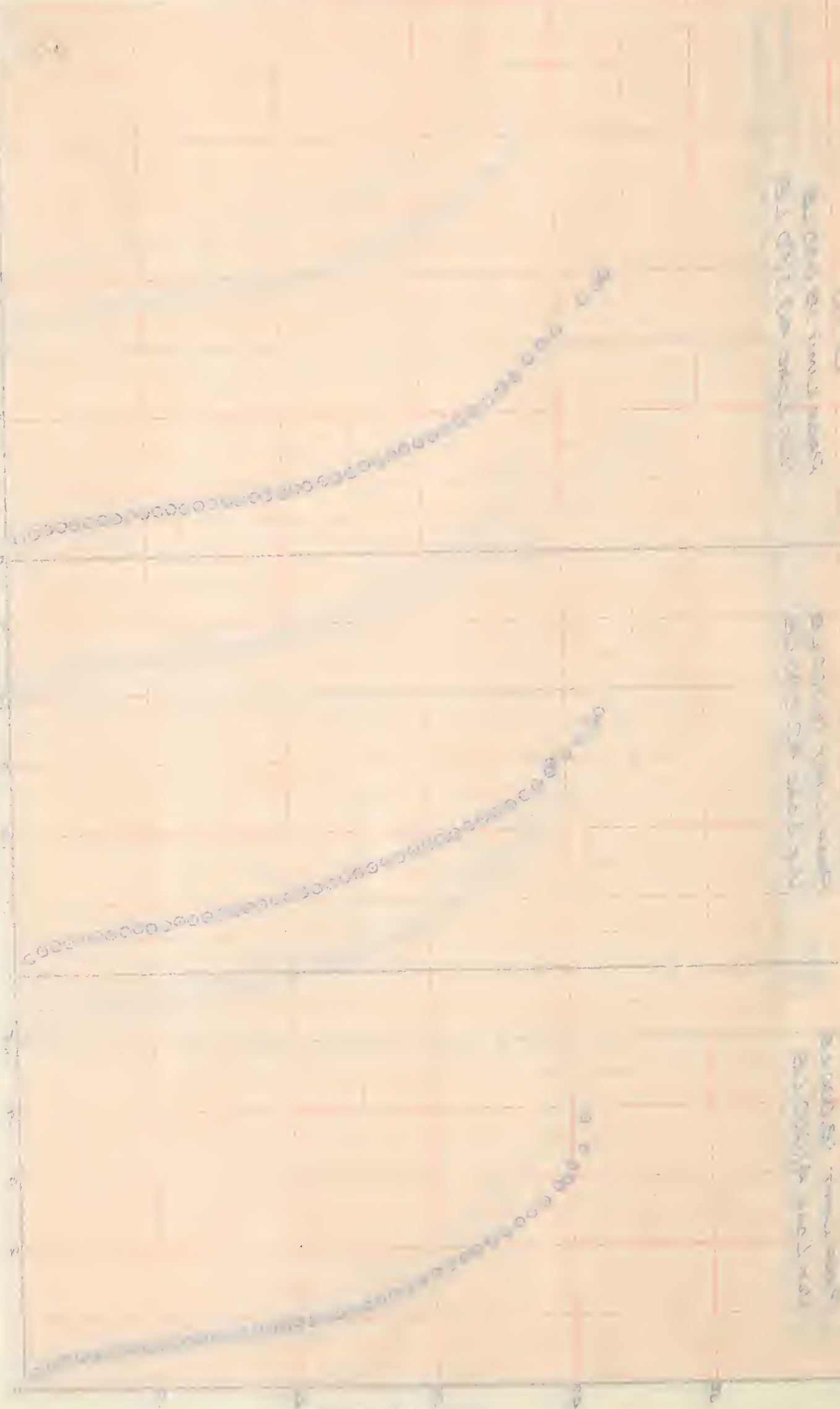
PROP. LIMIT 16,000 LB.
ULT. LOAD 42,500 LB.

D-15

PROP. LIMIT 18,000 LB.
ULT. LOAD 43,550 LB.



TEMPERATURE IN °C



Curve C is the steepest
Curve B is the middle
Curve A is the least steep

Curve A is the least steep
Curve B is the middle
Curve C is the steepest

Curve A is the least steep
Curve B is the middle
Curve C is the steepest

TEMPERATURE IN °C

TIME

TABLE 2A
BOLTED JOINT TEST RESULTS

SERIES A

(1) JOINT NO.	(2) MOISTURE CONTENT	(3) SPECIFIC GRAVITY	(4) FRICTION LOAD (FL)	(5) PROPOR- TIONAL LIMIT (PL)	(6) PL-FL	(7) CORRECTED PL-FL C(PL-FL)	(8) DEFLEC- TION AT PL
	%		LBS.	LBS.	LBS.	LBS.	IN.
A-1	10.8	.507	2,500	21,000	18,500	17,200	.1355
A-2	12.3	.451	5,500	26,000	20,500	22,100	.1999
A-3	11.3	.526	3,500	27,000	23,500	20,900	.1599
A-4	10.7	.515	3,500	25,000	21,500	19,700	.1576
A-5	11.1	.516	2,700	21,000	18,300	16,600	.1534
A-6	13.8	.473	5,300	27,000	21,700	22,100	.2016
A-7	11.8	.517	4,500	27,000	22,500	20,500	.1587
A-8	11.9	.472	4,500	27,000	22,500	23,000	.1843
A-9	12.4	.591	3,000	29,000	26,000	20,100	.1526
A-10	12.9	.476	4,500	26,000	21,500	21,700	.1727
A-11	12.8	.645	4,500	29,000	24,500	16,900	.1687
A-12	11.8	.575	3,000	27,000	24,000	19,100	.1573
A-13	12.3	.461	6,500	25,000	18,500	19,400	.1657
A-14	11.0	.508	3,500	27,000	23,500	21,900	.1559
A-15	11.5	.604	4,500	25,000	20,500	15,400	.1472
MEAN	11.9	.522	4,100	25,900	21,800	19,800	.1647

Table 1

Summary of data for the year 1998

Continued

Date	Time	Location	Altitude	Temperature	Humidity	Wind Speed	Wind Direction	Remarks
1998-01-01	08:00	1000m	1000	10.0	60%	10.0	SE	
1998-01-01	09:00	1000m	1000	11.0	65%	12.0	SE	
1998-01-01	10:00	1000m	1000	12.0	70%	15.0	SE	
1998-01-01	11:00	1000m	1000	13.0	75%	18.0	SE	
1998-01-01	12:00	1000m	1000	14.0	80%	20.0	SE	
1998-01-01	13:00	1000m	1000	15.0	85%	22.0	SE	
1998-01-01	14:00	1000m	1000	16.0	90%	25.0	SE	
1998-01-01	15:00	1000m	1000	17.0	95%	28.0	SE	
1998-01-01	16:00	1000m	1000	18.0	100%	30.0	SE	
1998-01-01	17:00	1000m	1000	19.0	100%	32.0	SE	
1998-01-01	18:00	1000m	1000	20.0	100%	35.0	SE	
1998-01-01	19:00	1000m	1000	21.0	100%	38.0	SE	
1998-01-01	20:00	1000m	1000	22.0	100%	40.0	SE	
1998-01-01	21:00	1000m	1000	23.0	100%	42.0	SE	
1998-01-01	22:00	1000m	1000	24.0	100%	45.0	SE	
1998-01-01	23:00	1000m	1000	25.0	100%	48.0	SE	
1998-01-02	00:00	1000m	1000	26.0	100%	50.0	SE	
1998-01-02	01:00	1000m	1000	27.0	100%	52.0	SE	
1998-01-02	02:00	1000m	1000	28.0	100%	55.0	SE	
1998-01-02	03:00	1000m	1000	29.0	100%	58.0	SE	
1998-01-02	04:00	1000m	1000	30.0	100%	60.0	SE	
1998-01-02	05:00	1000m	1000	31.0	100%	62.0	SE	
1998-01-02	06:00	1000m	1000	32.0	100%	65.0	SE	
1998-01-02	07:00	1000m	1000	33.0	100%	68.0	SE	
1998-01-02	08:00	1000m	1000	34.0	100%	70.0	SE	
1998-01-02	09:00	1000m	1000	35.0	100%	72.0	SE	
1998-01-02	10:00	1000m	1000	36.0	100%	75.0	SE	
1998-01-02	11:00	1000m	1000	37.0	100%	78.0	SE	
1998-01-02	12:00	1000m	1000	38.0	100%	80.0	SE	
1998-01-02	13:00	1000m	1000	39.0	100%	82.0	SE	
1998-01-02	14:00	1000m	1000	40.0	100%	85.0	SE	
1998-01-02	15:00	1000m	1000	41.0	100%	88.0	SE	
1998-01-02	16:00	1000m	1000	42.0	100%	90.0	SE	
1998-01-02	17:00	1000m	1000	43.0	100%	92.0	SE	
1998-01-02	18:00	1000m	1000	44.0	100%	95.0	SE	
1998-01-02	19:00	1000m	1000	45.0	100%	98.0	SE	
1998-01-02	20:00	1000m	1000	46.0	100%	100.0	SE	
1998-01-02	21:00	1000m	1000	47.0	100%	102.0	SE	
1998-01-02	22:00	1000m	1000	48.0	100%	105.0	SE	
1998-01-02	23:00	1000m	1000	49.0	100%	108.0	SE	
1998-01-03	00:00	1000m	1000	50.0	100%	110.0	SE	

TABLE 2A (CONT'D.)

BOLTED JOINT TEST RESULTSSERIES A (CONT'D.)

JOINT NO.	(9) ULTIMATE LOAD (UL)	(10) UL-FL	(11) CORRECTED UL-FL C(UL-FL)	(12) DEFLECTION AT UL	(13) $\frac{PL}{UL}$	(14) $\frac{(PL-FL)}{(UL-FL)}$
	LBS.	LBS.	LBS.	IN.		
A-1	38,650	36,150	33,700	.3450	.543	.512
A-2	35,550	30,050	32,400	.4295	.731	.682
A-3	39,500	36,000	32,100	.4300	.684	.653
A-4	37,950	34,450	31,600	.4195	.659	.624
A-5	33,300	30,600	27,800	.2960	.631	.598
A-6	39,800	34,500	35,200	.4150	.678	.629
A-7	35,700	31,200	28,400	.3200	.756	.721
A-8	35,550	31,050	31,700	.2940	.760	.724
A-9	43,500	40,500	31,300	.3115	.667	.642
A-10	39,250	34,750	35,100	.4520	.662	.619
A-11	48,700	44,200	30,600	.4150	.595	.554
A-12	39,550	36,550	29,200	.3475	.683	.657
A-13	38,950	32,450	34,100	.3755	.642	.570
A-14	36,200	32,700	30,500	.3360	.745	.719
A-15	34,650	30,150	22,600	.3300	.721	.680
MEAN	38,500	34,400	31,100	.3678	.677	.639

TABLE 2B
BOLTED JOINT TEST RESULTS
SERIES B

(1) JOINT NO.	(2) MOISTURE CONTENT	(3) SPECIFIC GRAVITY	(4) FRICTION LOAD (FL)	(5) PROPOR- TIONAL LIMIT (PL)	(6) PL-FL	(7) CORRECTED PL-FL C(PL-FL)	(8) DEFLEC- TION AT PL
	%		LBS.	LBS.	LBS.	LBS.	IN.
B-1	23.7	.509	3,000	20,000	17,000	15,800	.1386
B-2	24.9	.475	5,500	20,000	14,500	14,700	.1011
B-3	25.0	.468	5,000	20,000	15,000	15,500	.0926
B-4	22.4	.485	4,500	23,000	18,500	18,300	.1553
B-5	22.5	.461	3,500	16,000	12,500	13,200	.1198
B-6	19.8	.467	3,500	17,000	13,500	14,000	.1156
B-7	19.5	.470	4,500	17,000	12,500	12,800	.1061
B-8	22.5	.451	4,000	20,000	16,000	17,300	.1538
B-9	21.1	.504	4,000	22,000	18,000	17,000	.1860
B-10	20.3	.465	3,500	17,000	13,500	14,000	.1236
B-11	22.8	.462	3,000	17,000	14,000	14,700	.1205
B-12	22.7	.512	4,000	21,000	17,000	15,700	.1853
B-13	21.9	.448	3,000	16,000	13,000	14,200	.1219
B-14	21.0	.513	4,500	24,000	19,500	18,000	.1869
B-15	24.6	.459	5,500	17,000	11,500	12,200	.1110
MEAN	22.3	.477	4,100	19,100	15,100	15,200	.1345

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TABLE 2B (CONT'D.)

BOLTED JOINT TEST RESULTSSERIES B (CONT'D.)

JOINT NO.	(9) ULTIMATE LOAD (UL)	(10) UL-FL	(11) CORRECTED UL-FL C(UL-FL)	(12) DEFLECTION AT UL	(13) $\frac{PL}{UL}$	(14) $\frac{(PL-FL)}{(UL-FL)}$
	LBS.	LBS.	LBS.	IN.		
B-1	38,750	35,750	31,400	.5438	.517	.476
B-2	39,250	33,750	34,200	.6005	.510	.430
B-3	37,850	32,850	34,000	.4955	.528	.457
B-4	41,250	36,750	36,300	.5410	.557	.504
B-5	41,500	38,000	40,000	.6740	.386	.329
B-6	38,950	35,450	36,700	.5140	.437	.381
B-7	39,000	34,500	35,400	.5090	.436	.362
B-8	38,500	34,500	37,200	.5235	.520	.464
B-9	41,650	37,650	35,400	.6445	.528	.478
B-10	37,900	34,400	35,800	.6275	.448	.392
B-11	41,250	38,250	40,100	.7265	.412	.366
B-12	42,100	38,100	35,200	.6626	.498	.446
B-13	38,650	35,650	38,900	.5500	.414	.365
B-14	40,000	35,500	32,700	.5337	.600	.549
B-15	34,150	28,650	30,300	.5985	.498	.401
MEAN	39,400	35,300	35,600	.5830	.486	.427

TABLE 2C
BOLTED JOINT TEST RESULTS
SERIES C

(1) JOINT NO.	(2) MOISTURE CONTENT	(3) SPECIFIC GRAVITY	(4) FRICTION LOAD (FL)	(5) PROPOR- TIONAL LIMIT (PL)	(6) PL-FL	(7) CORRECTED PL-FL C(PL-FL)	(8) DEFLEC- TION AT PL
	%		LBS.	LBS.	LBS.	LBS.	IN.
C-1	9.3	.440	7,000	25,000	18,000	20,100	.0826
C-2	9.4	.454	5,000	27,000	22,000	23,600	.1099
C-3	9.5	.466	7,500	27,000	19,500	20,200	.0904
C-4	9.8	.474	5,500	24,000	18,500	18,800	.0952
C-5	9.6	.483	6,000	26,000	20,000	19,900	.1051
C-6	9.6	.479	6,500	28,000	21,500	21,500	.1110
C-7	10.0	.580	6,000	29,000	23,000	18,200	.0999
C-8	9.6	.501	6,000	27,000	21,000	19,900	.0929
C-9	10.1	.575	6,000	31,000	25,000	20,000	.0783
C-10	9.6	.498	4,000	28,000	24,000	22,900	.1010
C-11	9.6	.497	6,000	28,000	22,000	21,000	.0918
C-12	9.6	.511	5,000	27,000	22,000	20,300	.0929
C-13	9.5	.482	6,000	27,000	21,000	20,900	.0935
C-14	8.8	.537	7,500	32,000	24,500	21,300	.1549
C-15	8.5	.520	7,000	32,000	25,000	22,600	.1669
MEAN	9.5	.500	6,100	27,900	21,800	20,700	.1044

1911 Annual Report of the Board of Education

(1) Name of School	(2) Address	(3) Principal	(4) Teacher	(5) Number of Pupils	(6) Value of Property	(7) Value of School	(8) Value of Land
1001.	1001 E. 1st	1001 E. 1st	1001 E. 1st	1001	1001	1001	1001
1002.	1002 E. 1st	1002 E. 1st	1002 E. 1st	1002	1002	1002	1002
1003.	1003 E. 1st	1003 E. 1st	1003 E. 1st	1003	1003	1003	1003
1004.	1004 E. 1st	1004 E. 1st	1004 E. 1st	1004	1004	1004	1004
1005.	1005 E. 1st	1005 E. 1st	1005 E. 1st	1005	1005	1005	1005
1006.	1006 E. 1st	1006 E. 1st	1006 E. 1st	1006	1006	1006	1006
1007.	1007 E. 1st	1007 E. 1st	1007 E. 1st	1007	1007	1007	1007
1008.	1008 E. 1st	1008 E. 1st	1008 E. 1st	1008	1008	1008	1008
1009.	1009 E. 1st	1009 E. 1st	1009 E. 1st	1009	1009	1009	1009
1010.	1010 E. 1st	1010 E. 1st	1010 E. 1st	1010	1010	1010	1010
1011.	1011 E. 1st	1011 E. 1st	1011 E. 1st	1011	1011	1011	1011
1012.	1012 E. 1st	1012 E. 1st	1012 E. 1st	1012	1012	1012	1012
1013.	1013 E. 1st	1013 E. 1st	1013 E. 1st	1013	1013	1013	1013
1014.	1014 E. 1st	1014 E. 1st	1014 E. 1st	1014	1014	1014	1014
1015.	1015 E. 1st	1015 E. 1st	1015 E. 1st	1015	1015	1015	1015
1016.	1016 E. 1st	1016 E. 1st	1016 E. 1st	1016	1016	1016	1016
1017.	1017 E. 1st	1017 E. 1st	1017 E. 1st	1017	1017	1017	1017
1018.	1018 E. 1st	1018 E. 1st	1018 E. 1st	1018	1018	1018	1018
1019.	1019 E. 1st	1019 E. 1st	1019 E. 1st	1019	1019	1019	1019
1020.	1020 E. 1st	1020 E. 1st	1020 E. 1st	1020	1020	1020	1020

TABLE 2C (CONT'D.)

BOLTED JOINT TEST RESULTSSERIES C (CONT'D.)

JOINT NO.	(9) ULTIMATE LOAD (UL)	(10) UL-FL	(11) CORRECTED UL-FL C(UL-FL)	(12) DEFLECTION AT UL	(13) PL UL	(14) (PL-FL) (UL-FL)
	LBS.	LBS.	LBS.	IN.		
C-1	41,800	34,800	38,800	.2880	.598	.517
C-2	47,050	42,050	45,200	.3524	.574	.523
C-3	52,000	44,500	46,100	.4475	.519	.438
C-4	45,000	39,500	40,100	.3935	.534	.468
C-5	43,750	37,750	37,400	.2940	.594	.530
C-6	48,400	41,900	41,900	.3900	.579	.514
C-7	54,000	48,000	37,900	.4740	.537	.479
C-8	45,200	39,200	37,200	.2494	.598	.536
C-9	59,000	53,000	42,300	.5065	.525	.472
C-10	42,900	38,900	37,200	.2460*	.653	.617
C-11	48,100	42,100	40,300	.3590	.582	.523
C-12	49,200	44,200	40,800	.3925	.549	.498
C-13	44,250	38,250	38,000	.2710	.610	.549
C-14	48,900	41,400	36,000	.3765	.655	.592
C-15	43,500	36,500	33,000	.3780	.736	.685
MEAN	47,500	41,500	39,500	.3694	.589	.529

* Deflection at 400 pounds below ultimate load. Not included in mean.

TABLE 2D
BOLTED JOINT TEST RESULTS

SERIES D

(1) JOINT NO.	(2) MOISTURE CONTENT	(3) SPECIFIC GRAVITY	(4) FRICTION LOAD (FL)	(5) PROPOR- TIONAL LIMIT (PL)	(6) PL-FL	(7) CORRECTED PL-FL C(PL-FL)	(8) DEFLEC- TION AT PL
	%		LBS.	LBS.	LBS.	LBS.	IN.
D-1	9.1	.485	0	19,000	19,000	18,800	.0969
D-2	9.2	.488	0	19,000	19,000	18,600	.0853
D-3	9.4	.486	0	18,000	18,000	17,700	.0731
D-4	9.3	.506	0	20,000	20,000	18,700	.0898
D-5	8.9	.444	0	14,000	14,000	15,500	.0820
D-6	9.4	.538	0	21,000	21,000	18,200	.1126
D-7	9.5	.565	0	21,000	21,000	17,100	.0851
D-8	9.2	.495	0	17,000	17,000	16,400	.0648
D-9	9.1	.479	0	18,000	18,000	18,000	.0811
D-10	9.4	.488	0	18,000	18,000	17,600	.0866
D-11	8.8	.456	0	19,000	19,000	20,200	.0794
D-12	9.3	.488	0	20,000	20,000	19,600	.0953
D-13	8.8	.444	0	18,000	18,000	19,900	.0855
D-14	8.5	.503	0	16,000	16,000	15,100	.0877
D-15	9.1	.490	0	18,000	18,000	17,600	.0821
MEAN	9.1	.490	0	18,400	18,400	17,900	.0858

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21		22		23		24	
25		26		27		28	
29		30		31		32	
33		34		35		36	
37		38		39		40	
41		42		43		44	
45		46		47		48	
49		50		51		52	
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57		58		59		60	
61		62		63		64	
65		66		67		68	
69		70		71		72	
73		74		75		76	
77		78		79		80	
81		82		83		84	
85		86		87		88	
89		90		91		92	
93		94		95		96	
97		98		99		100	

TABLE 2D (CONT'D.)

BOLTED JOINT TEST RESULTSSERIES D (CONT'D.)

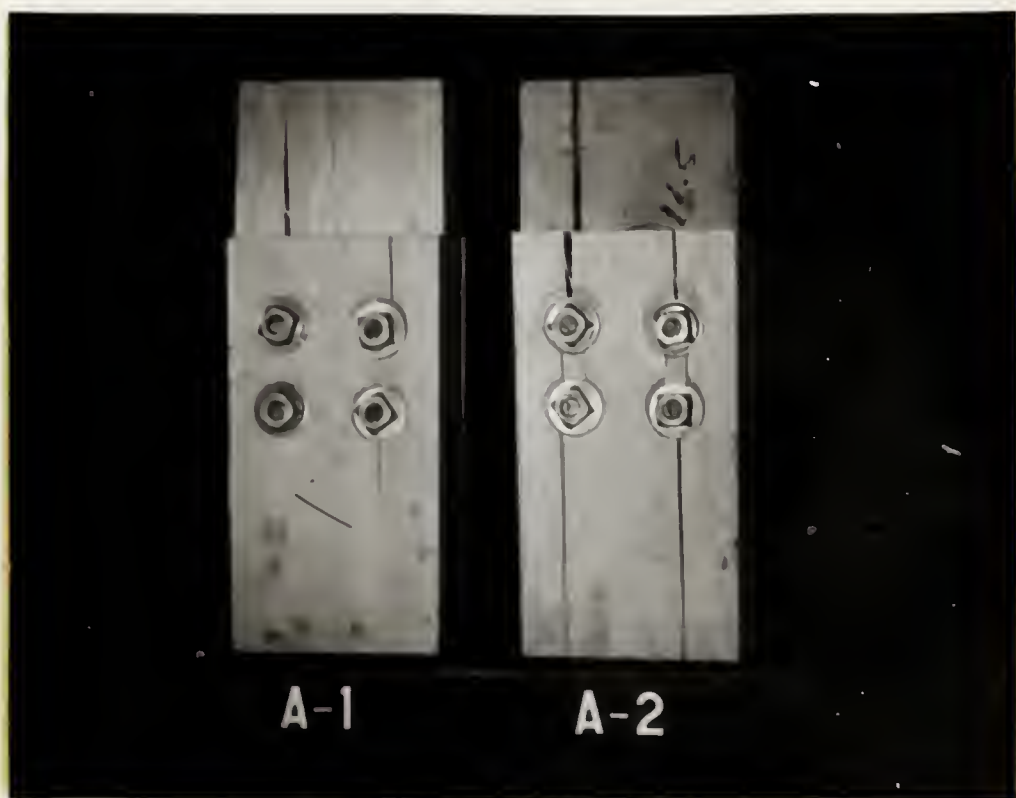
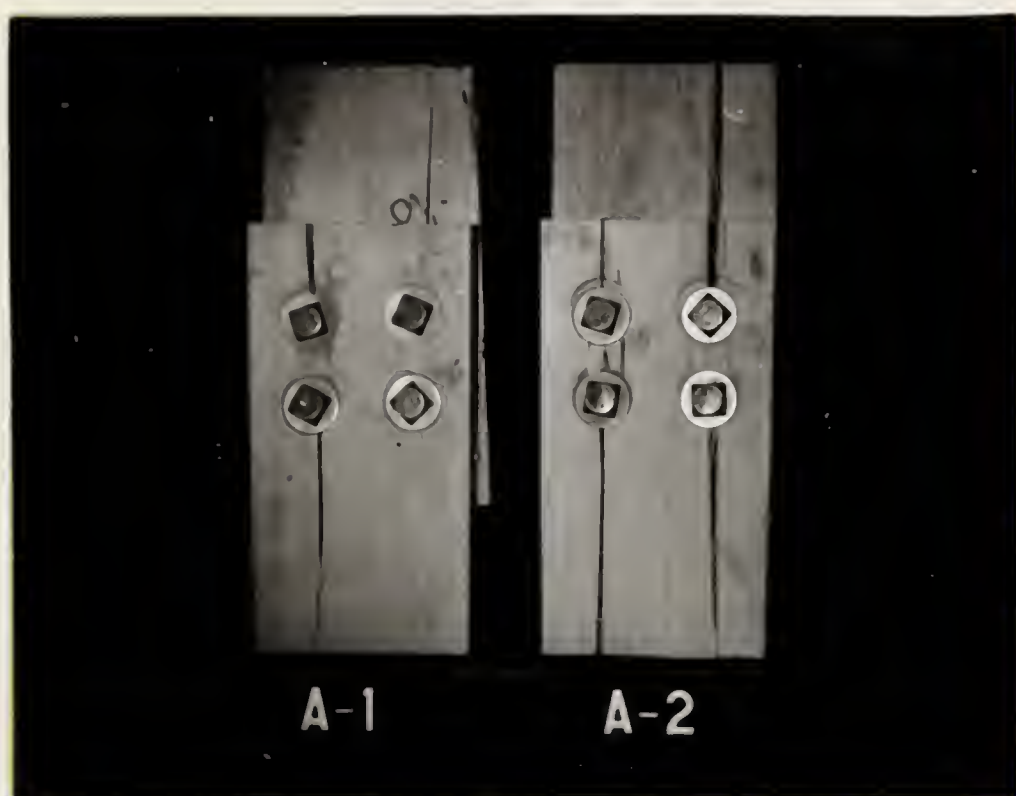
JOINT NO.	(9) ULTIMATE LOAD (UL)	(10) UL-FL	(11) CORRECTED UL-FL C(UL-FL)	(12) DEFLECTION AT UL	(13) $\frac{PL}{UL}$	(14) $\frac{(PL-FL)}{(UL-FL)}$
	LBS.	LBS.	LBS.	IN.		
D-1	42,200	42,200	41,700	.4120	.450	.450
D-2	35,900	35,900	35,200	.2625	.529	.529
D-3	40,600	40,600	40,000	.3410	.443	.443
D-4	38,900	38,900	36,400	.3015	.514	.514
D-5	40,250	40,250	44,500	.4115	.348	.348
D-6	43,300	43,300	37,600	.4360	.485	.485
D-7	56,400	56,400	46,000	.5620	.373	.373
D-8	38,700	38,700	37,300	.3355	.439	.439
D-9	35,450	35,450	35,450	.2962 [*]	.508	.508
D-10	40,200	40,200	39,400	.3807 ^x	.448	.448
D-11	37,350	37,350	39,800	.3230	.509	.509
D-12	38,650	38,650	37,800	.2942	.517	.517
D-13	41,000	41,000	45,300	.3825	.439	.439
D-14	42,500	42,500	40,100	.3637	.376	.376
D-15	43,550	43,550	42,500	.3950	.413	.413
MEAN	41,000	41,000	39,900	.3708	.453	.453

* Deflection at 50 pounds below ultimate load. Not included in mean.

x Deflection at 200 pounds below ultimate load. Not included in mean.

TABLE 3
BOLTED JOINT TEST RESULTS
MEAN VALUES FOR EACH SERIES

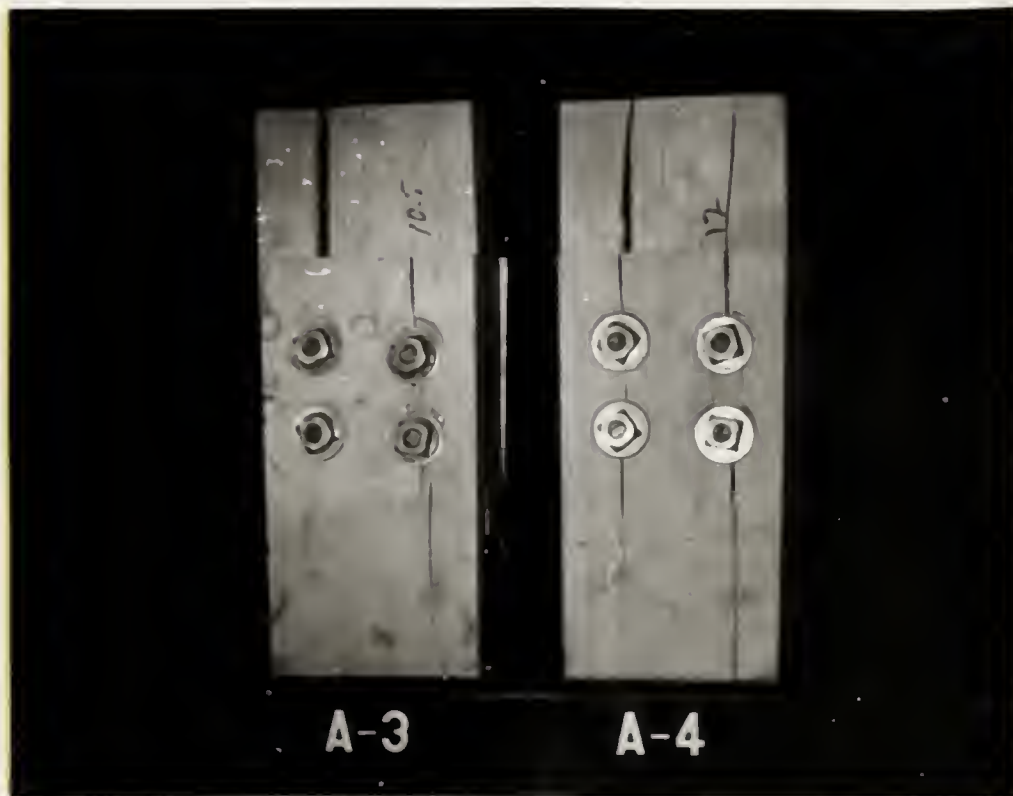
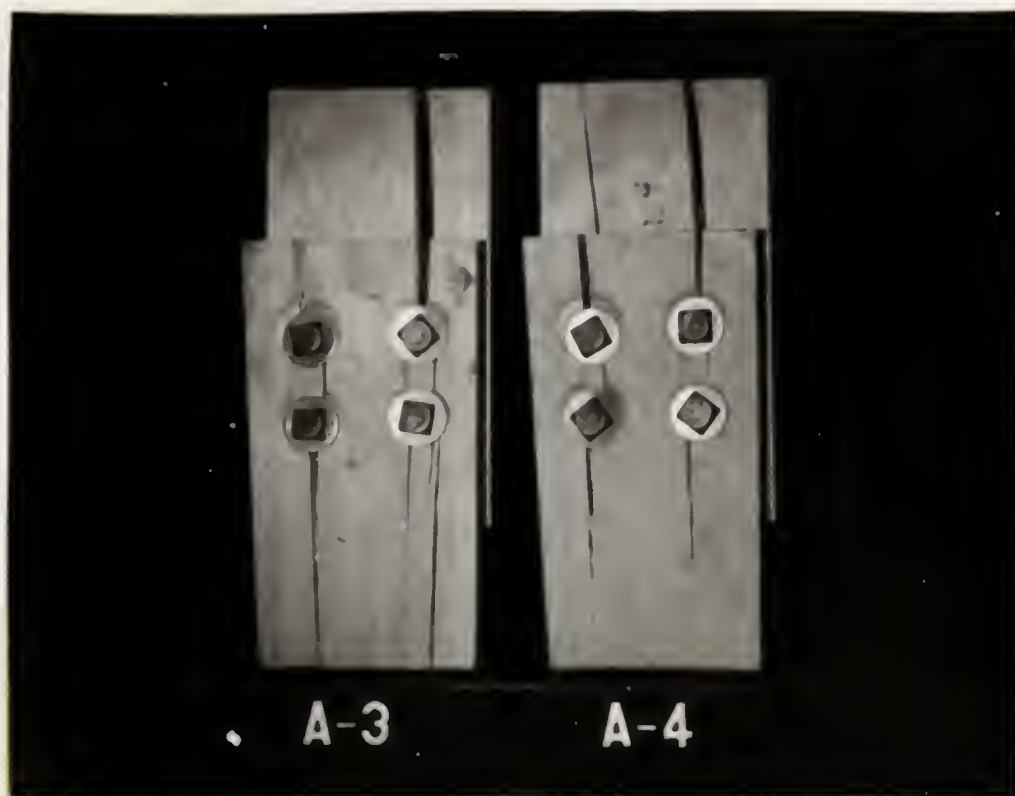
	<u>SERIES A</u>	<u>SERIES B</u>	<u>SERIES C</u>	<u>SERIES D</u>
Moisture Content %	11.9	22.3	9.5	9.1
Specific Gravity	.522	.477	.500	.490
Friction Load (FL) Lbs.	4,100	4,100	6,100	0
Proportional Limit (PL) Lbs.	25,900	19,100	27,900	18,400
PL-FL Lbs.	21,800	15,100	21,800	18,400
Corrected PL-FL C(PL-FL) Lbs.	19,800	15,200	20,700	17,900
Deflection at PL In.	.1647	.1345	.1044	.0858
Ultimate Load (UL) Lbs.	38,500	39,400	47,500	41,000
UL-FL Lbs.	34,400	35,300	41,500	41,000
Corrected UL-FL C(UL-FL) Lbs.	31,100	35,600	39,500	39,900
Deflection at UL In.	.3678	.5830	.3694	.3708
$\frac{PL}{UL}$	.677	.486	.589	.453
$\frac{(PL-FL)}{(UL-FL)}$.639	.427	.529	.453



SPECIMENS AFTER TESTING

FIGURE 9 - 1





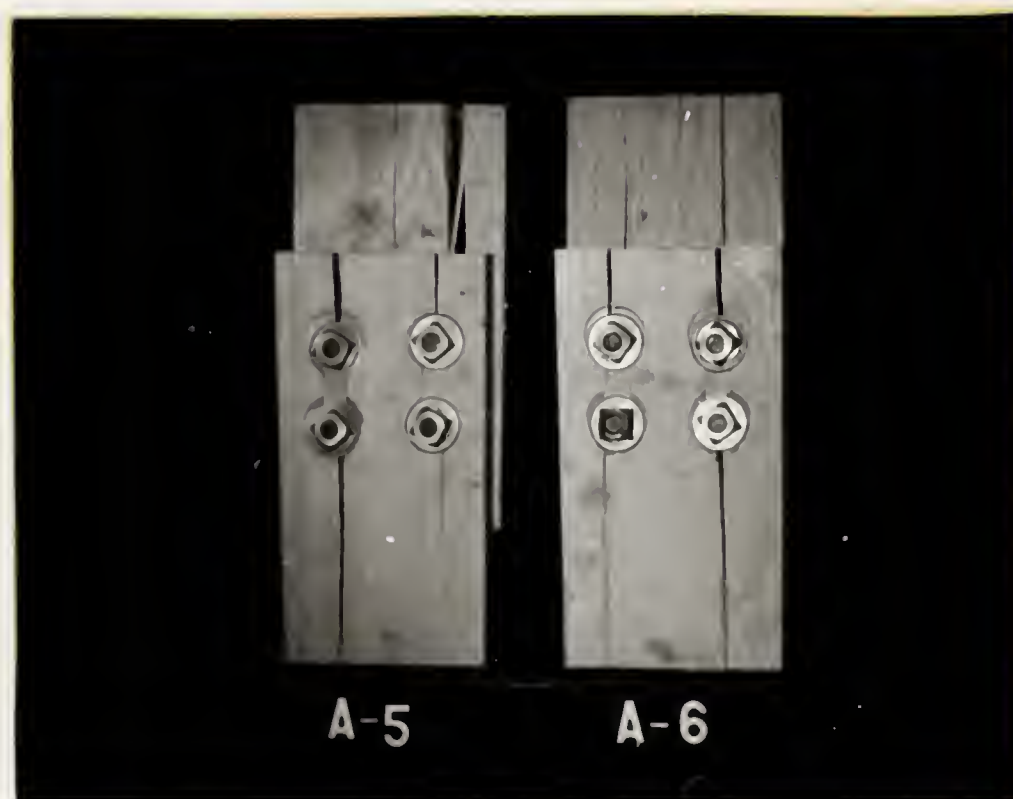
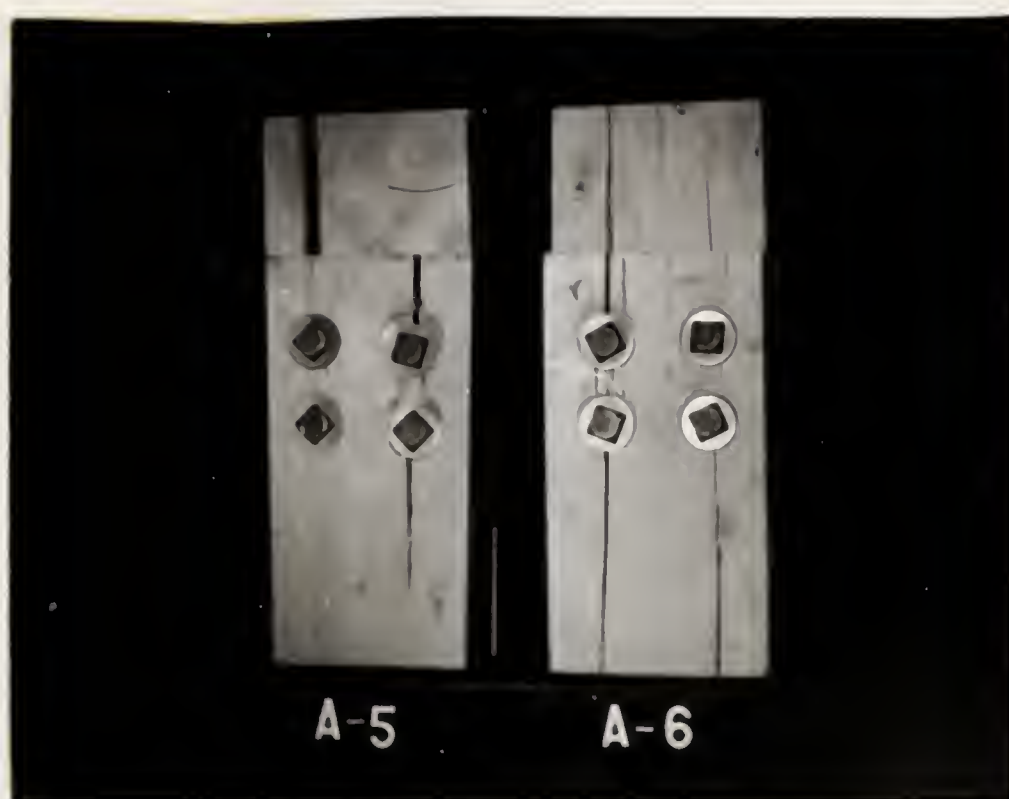
SPECIMENS AFTER TESTING

FIGURE 9 - 2



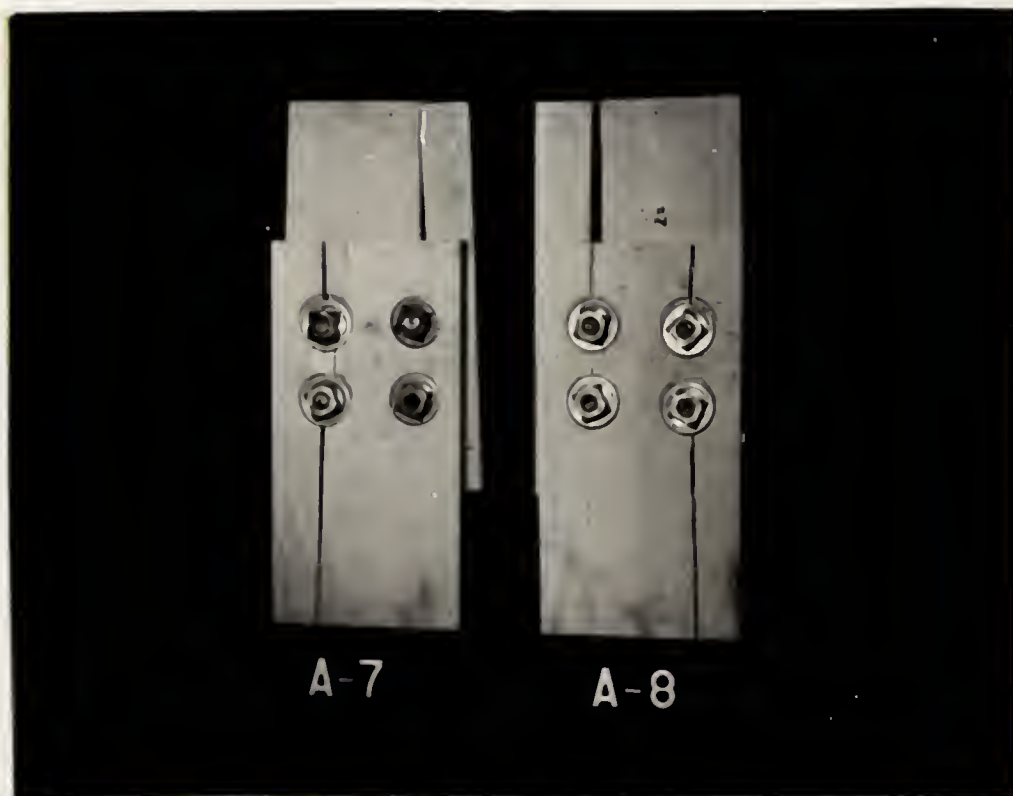
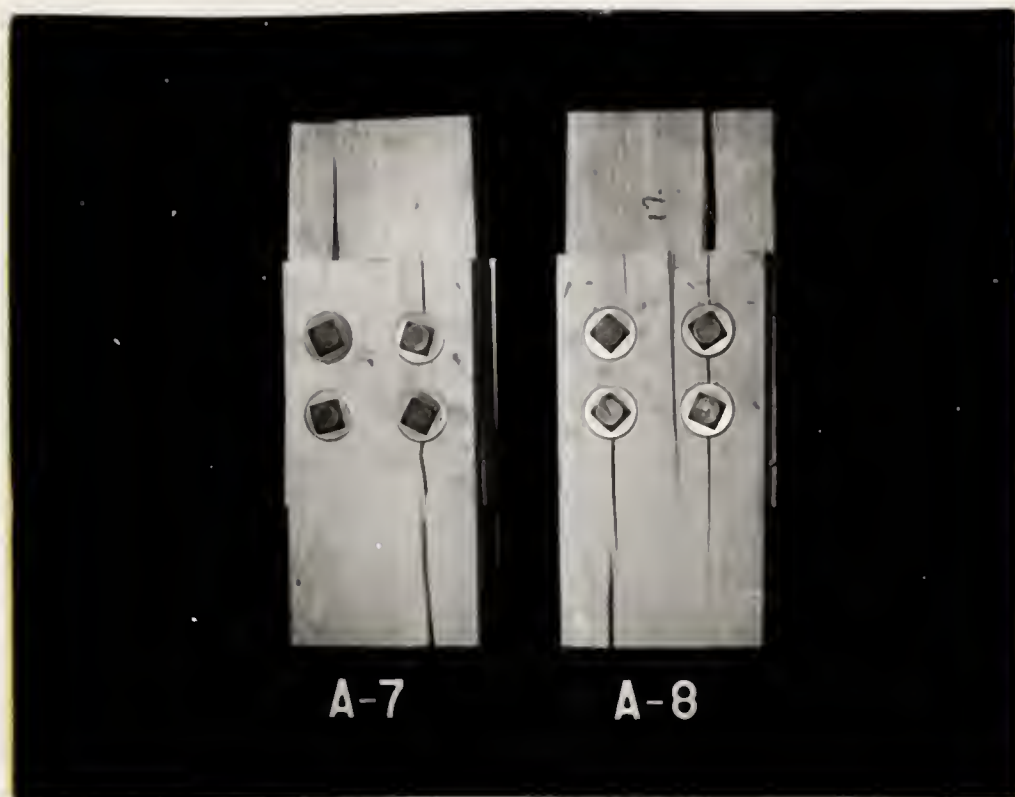
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SPECIMENS AFTER TESTING

FIGURE 9 - 3

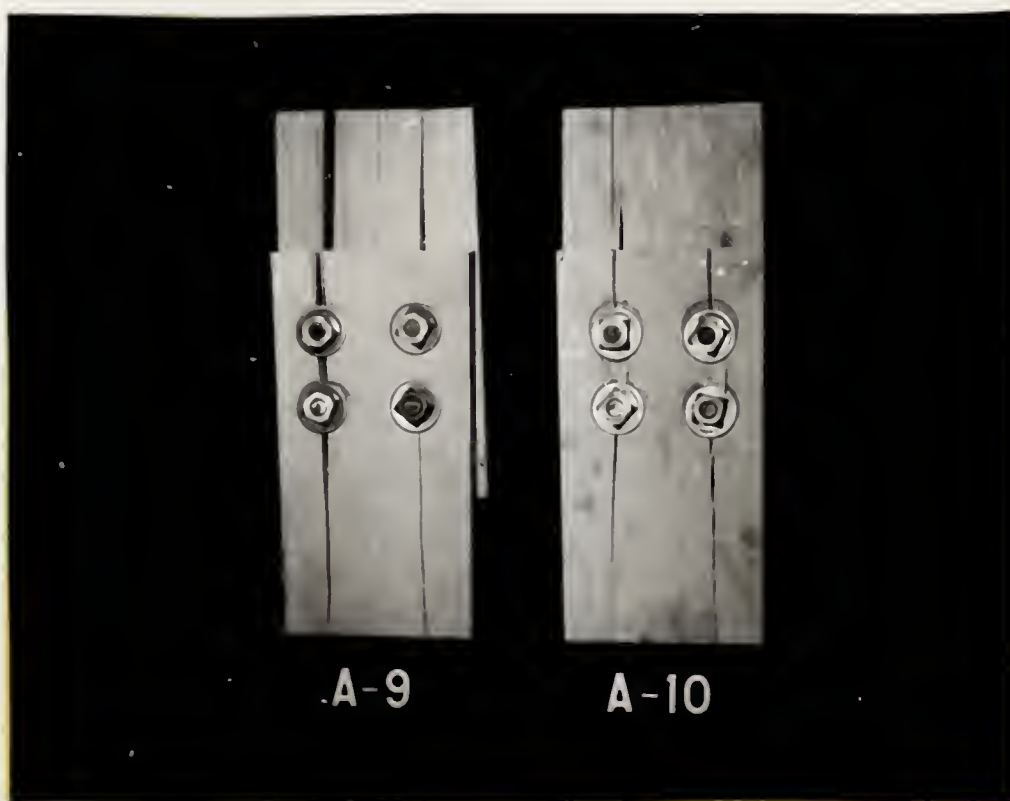
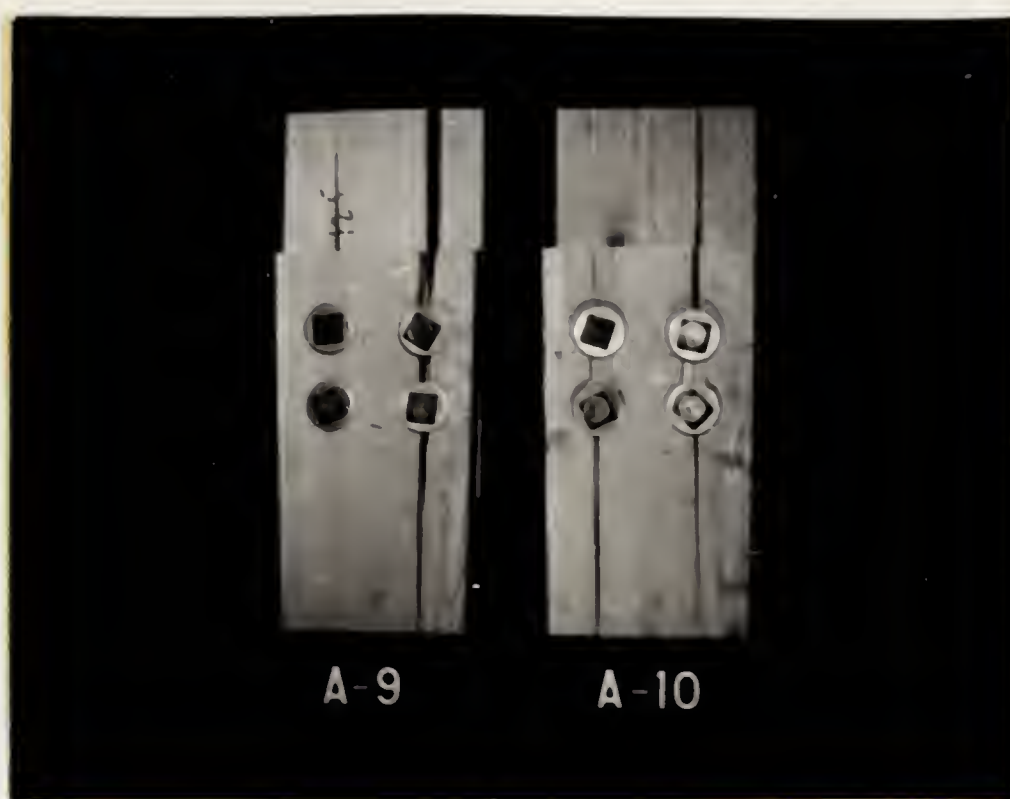


SPECIMENS AFTER TESTING

FIGURE 9 - 4



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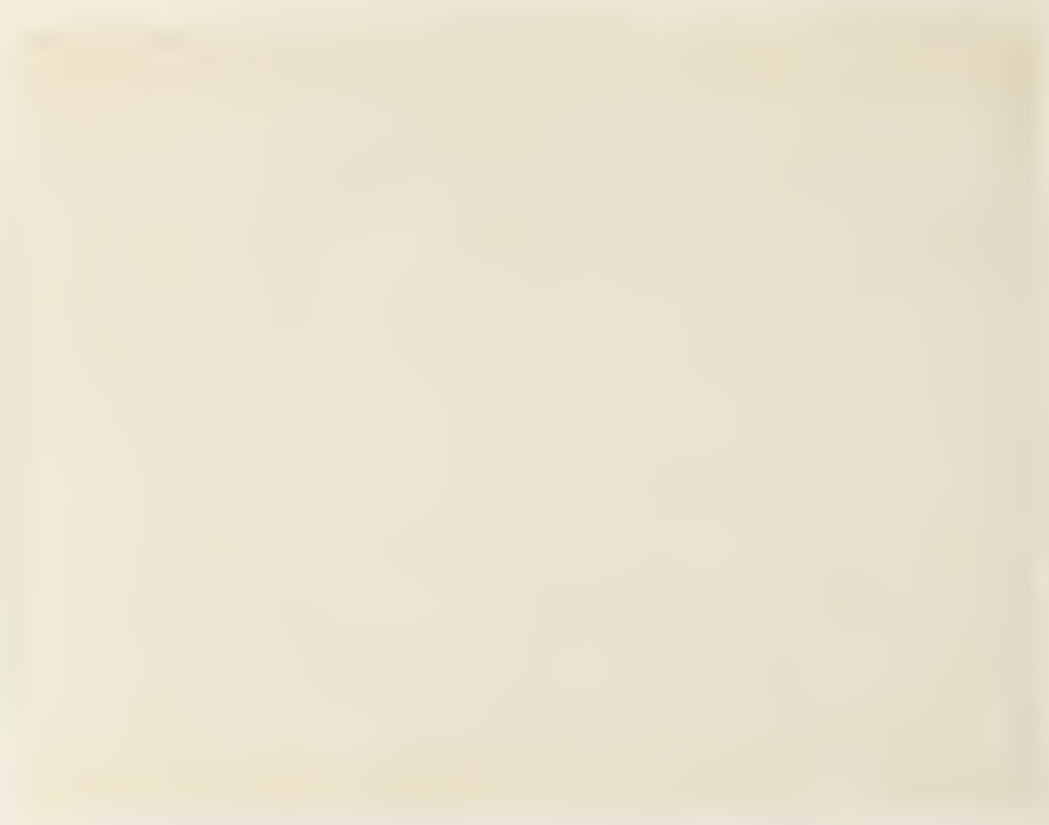
FIGURE 9 - 5



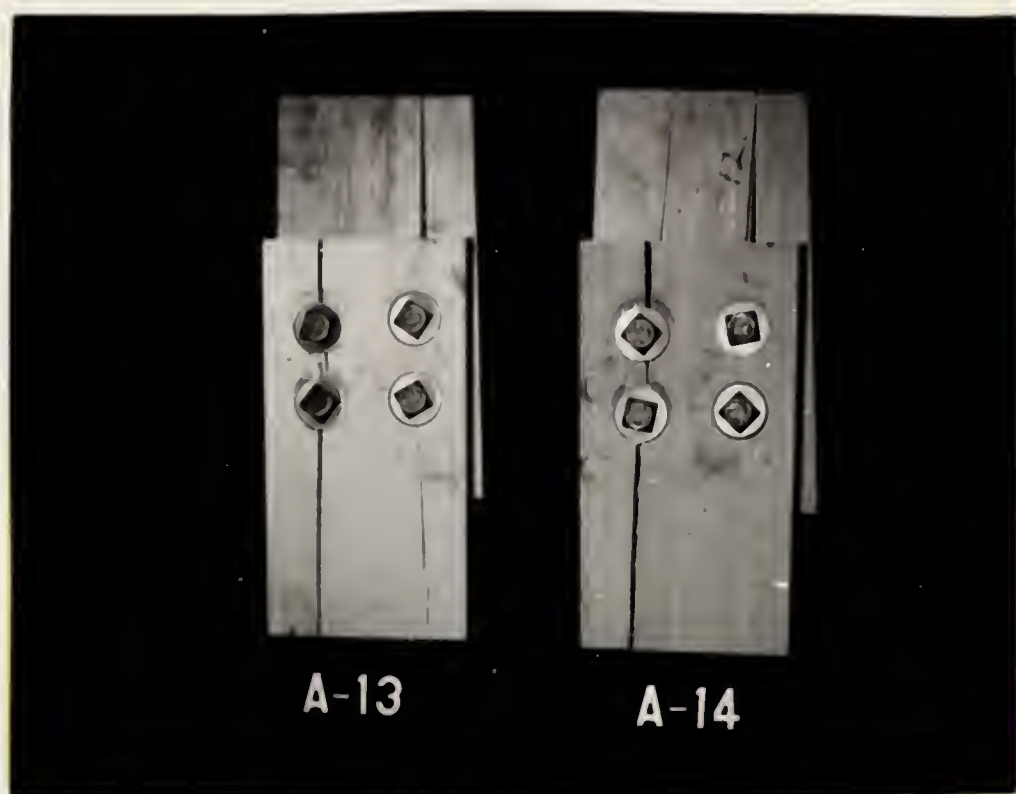


SPECIMENS AFTER TESTING

FIGURE 9 - 6



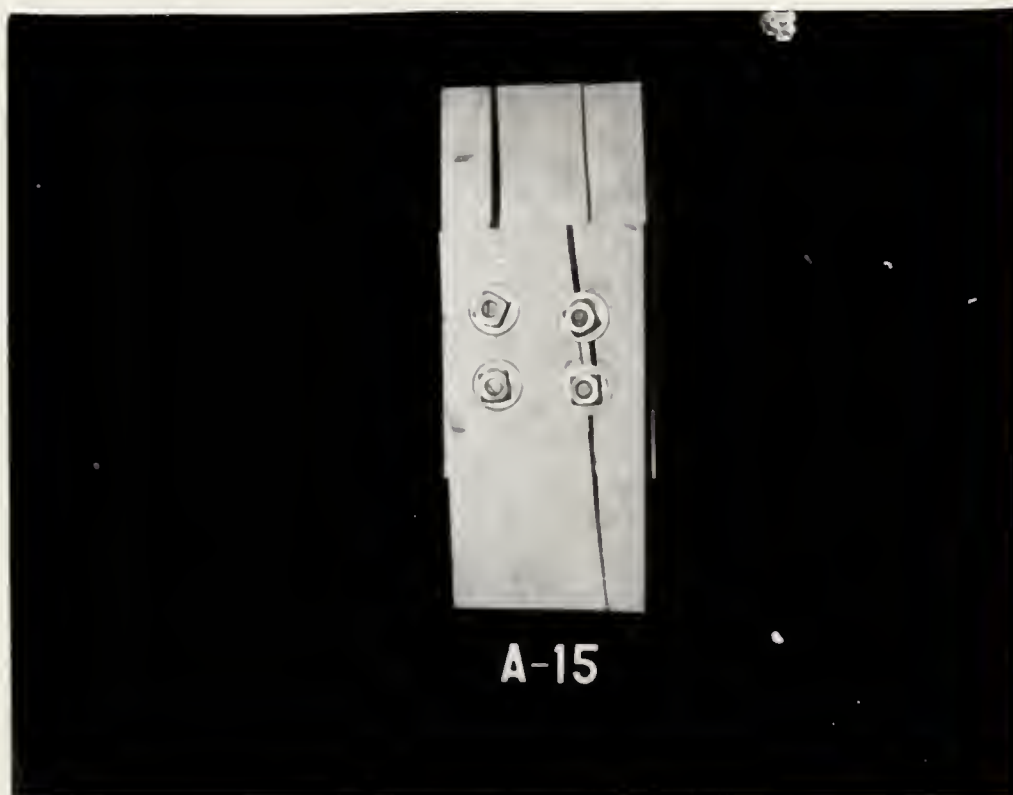
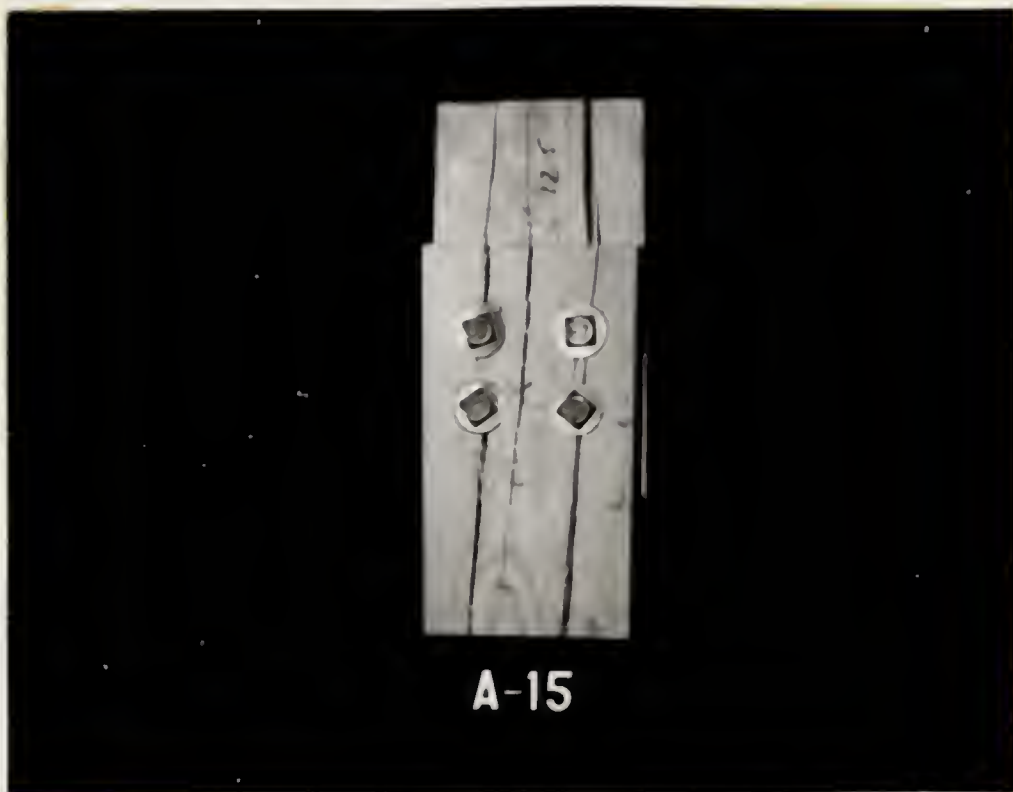
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SPECIMENS AFTER TESTING

FIGURE 9 - 7

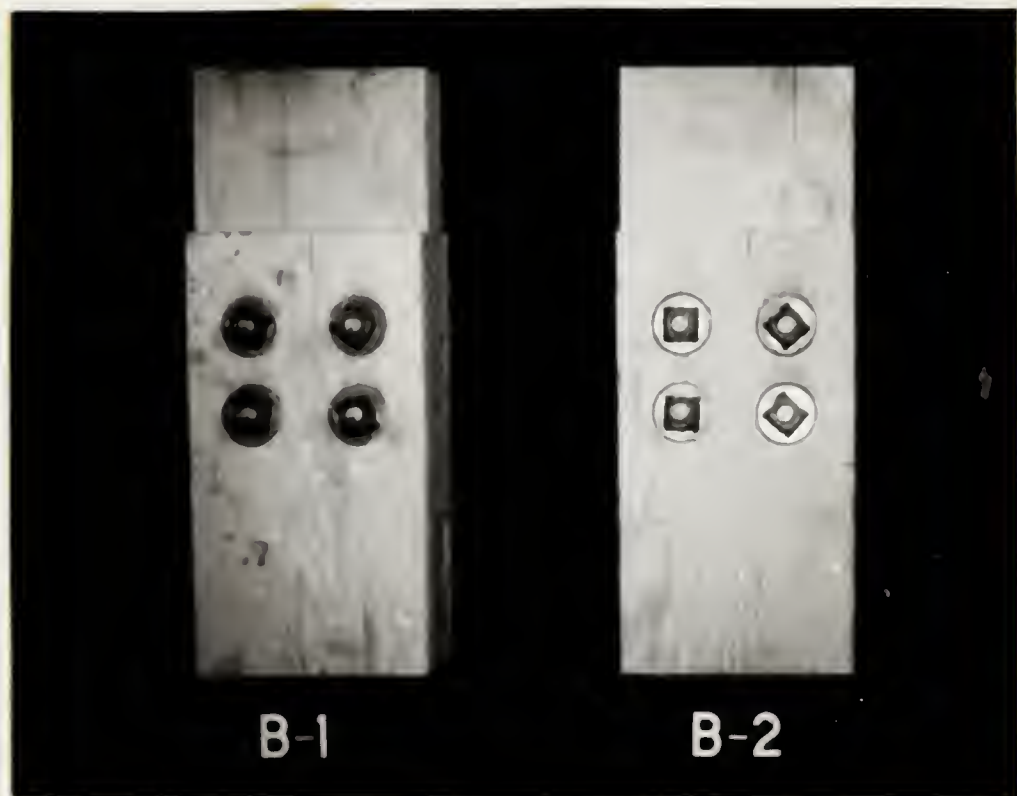
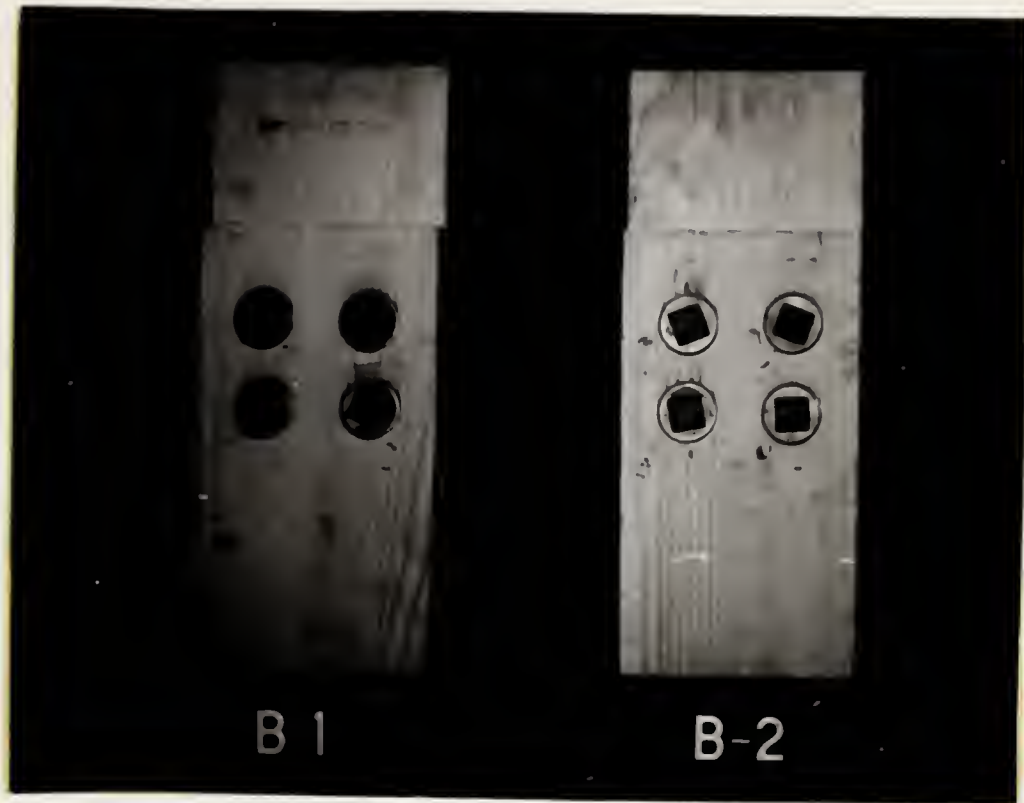




SPECIMENS AFTER TESTING

FIGURE 9 - 8

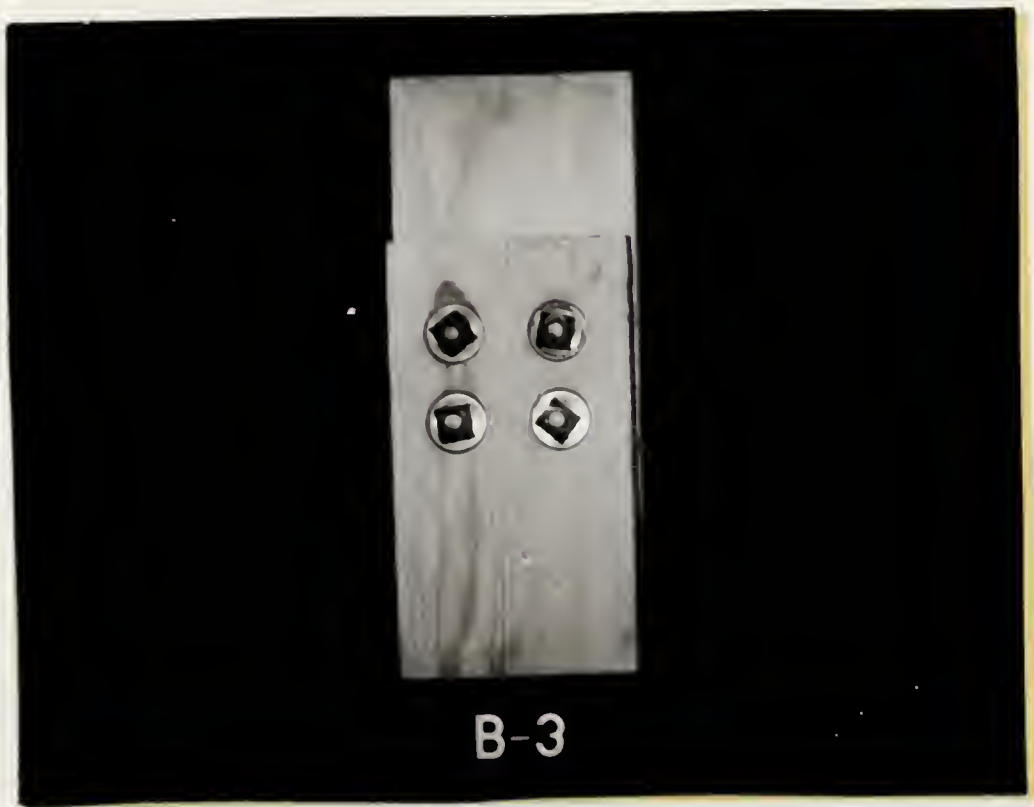
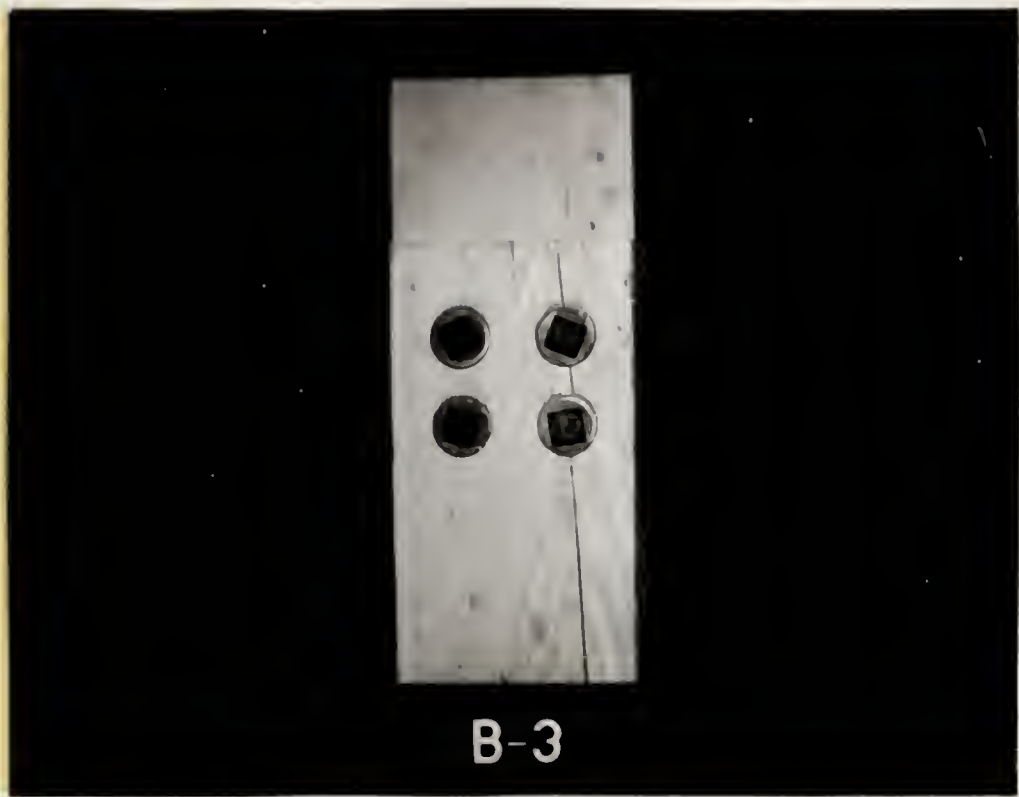




SPECIMENS AFTER TESTING

FIGURE 10 - 1

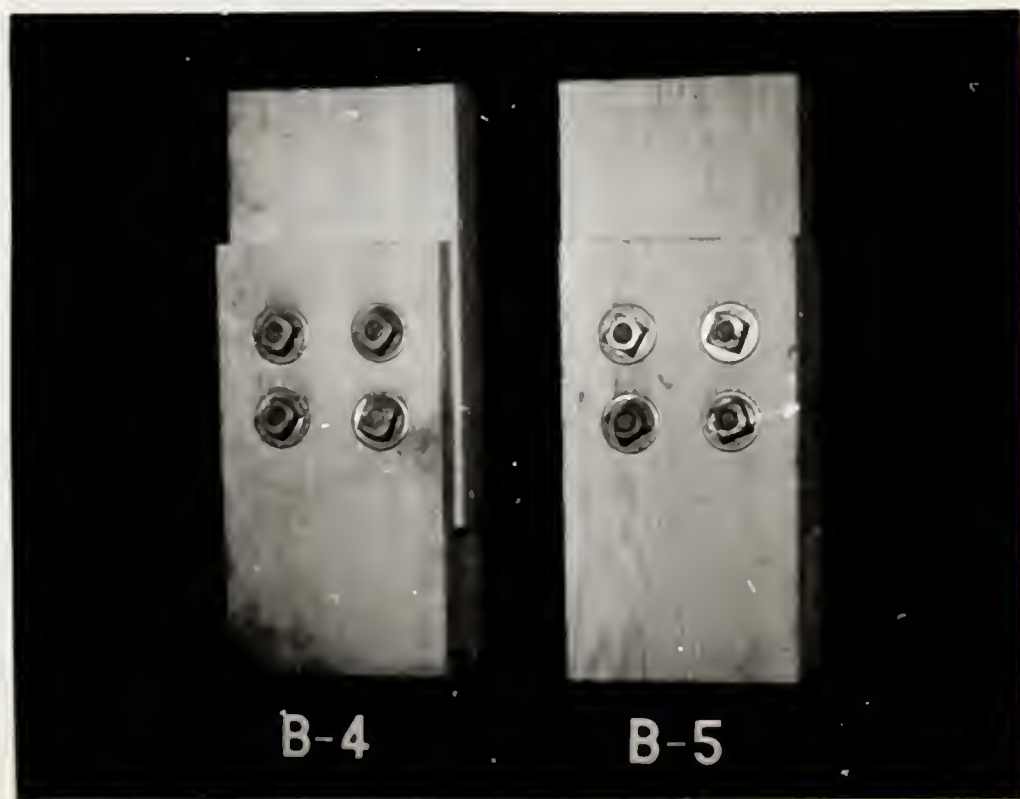
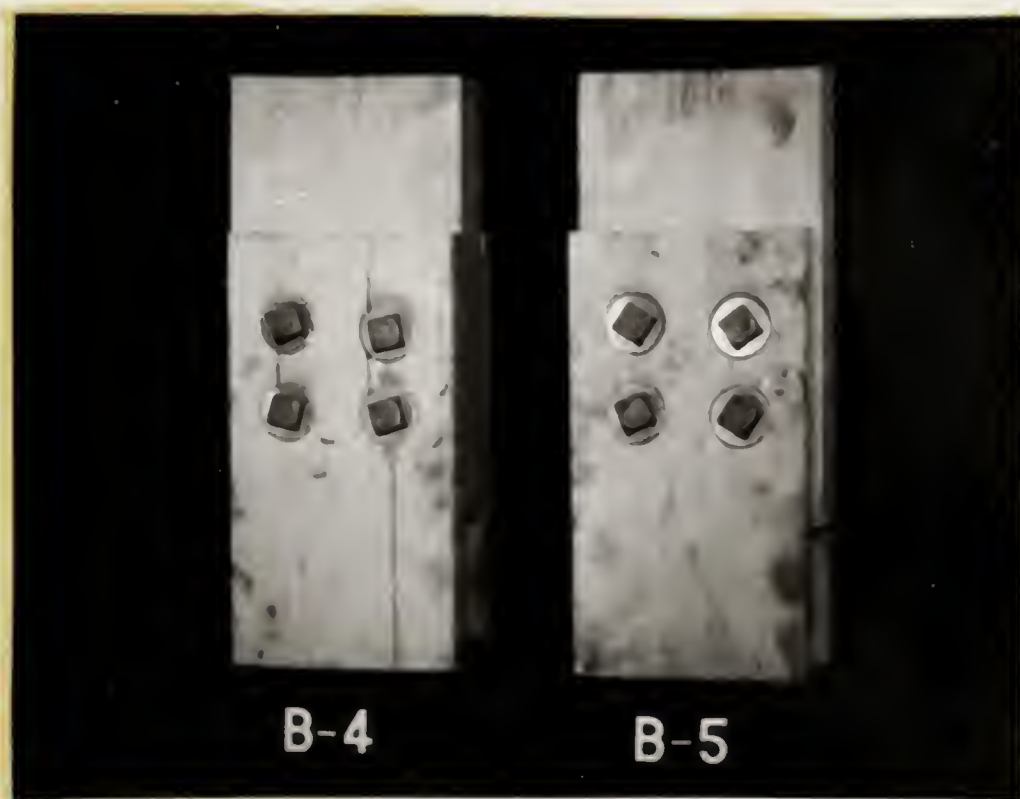




SPECIMENS AFTER TESTING

FIGURE 10 - 2





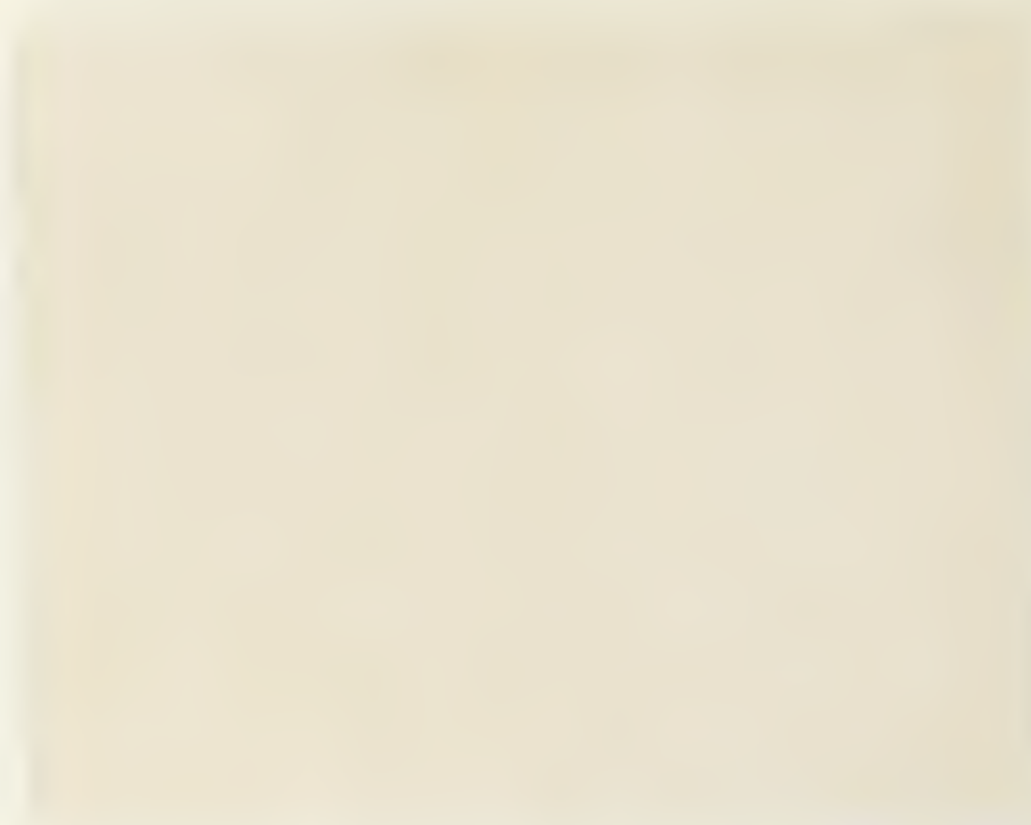
SPECIMENS AFTER TESTING

FIGURE 10 - 3

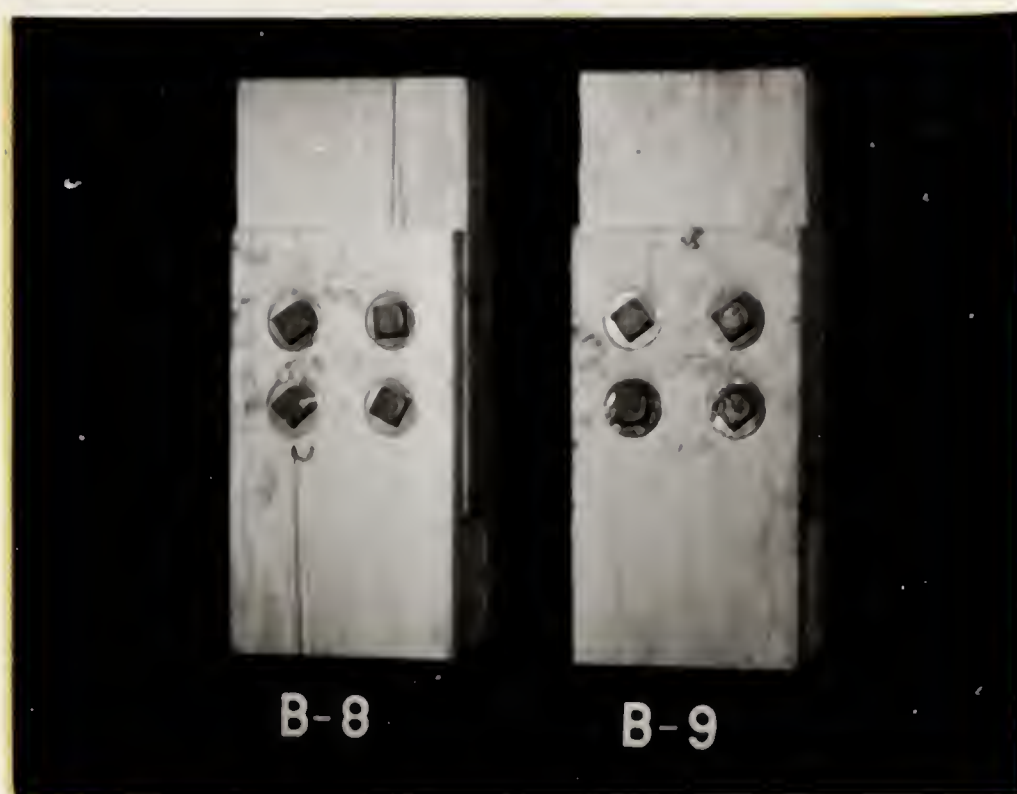


SPECIMENS AFTER TESTING

FIGURE 10 - 4



THE
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SPECIMENS AFTER TESTING

FIGURE 10 - 5



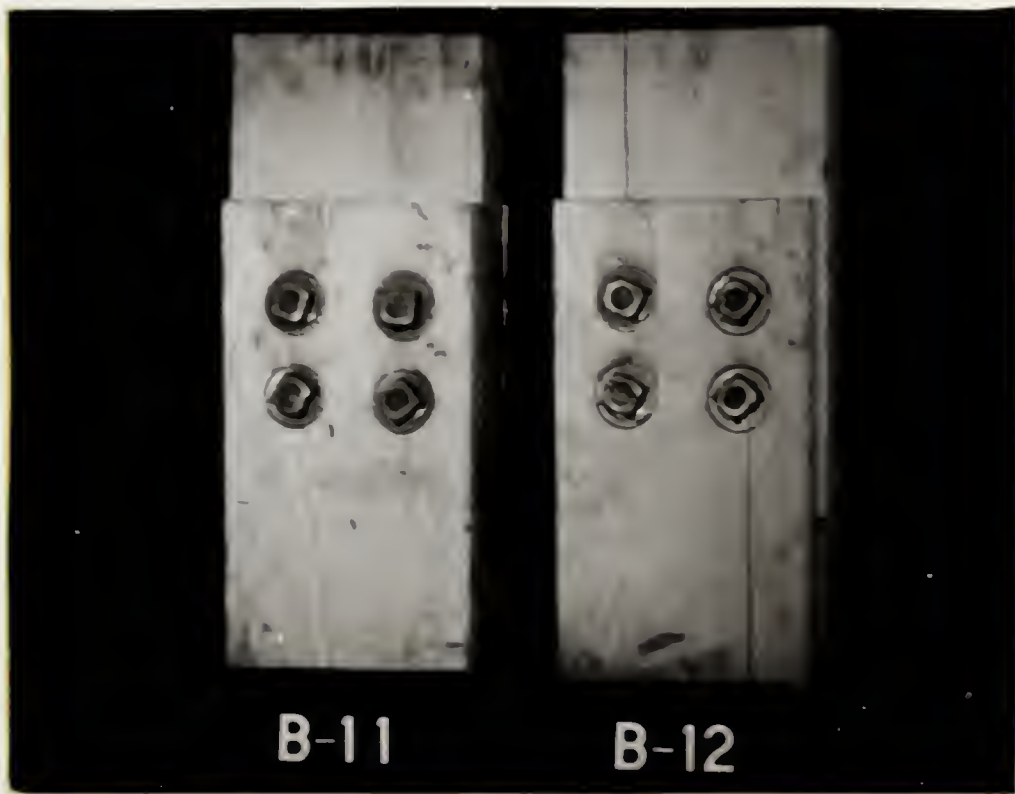
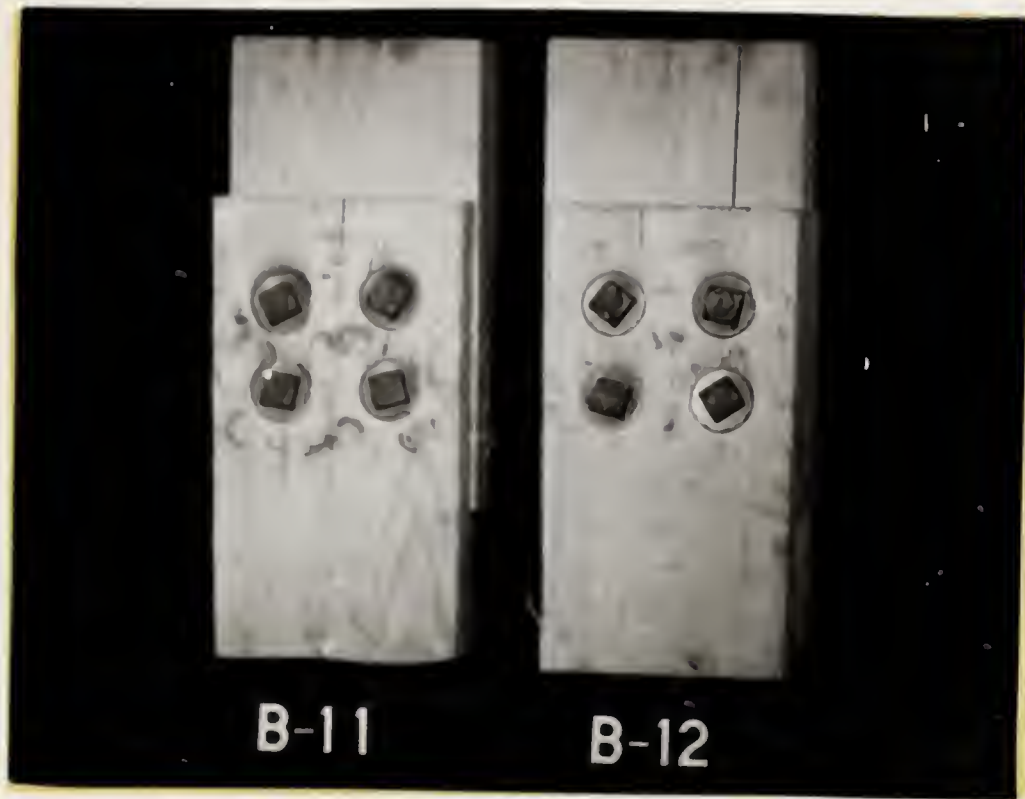


SPECIMENS AFTER TESTING

FIGURE 10 - 6

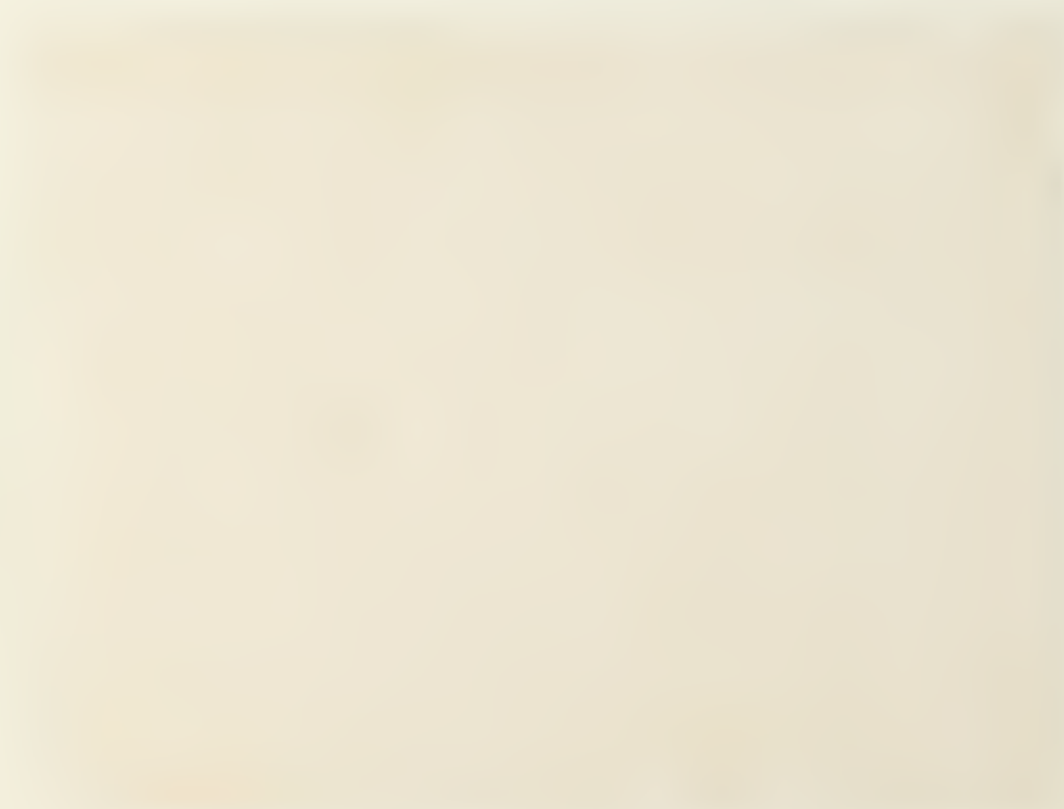


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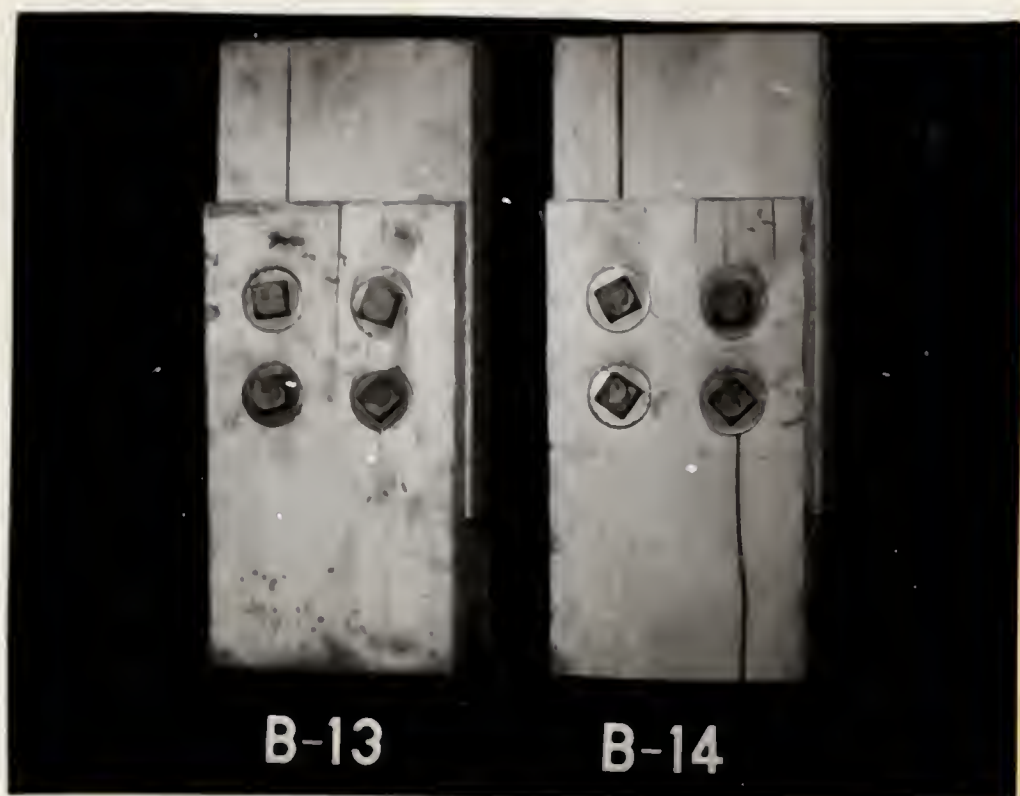


SPECIMENS AFTER TESTING

FIGURE 10 - 7

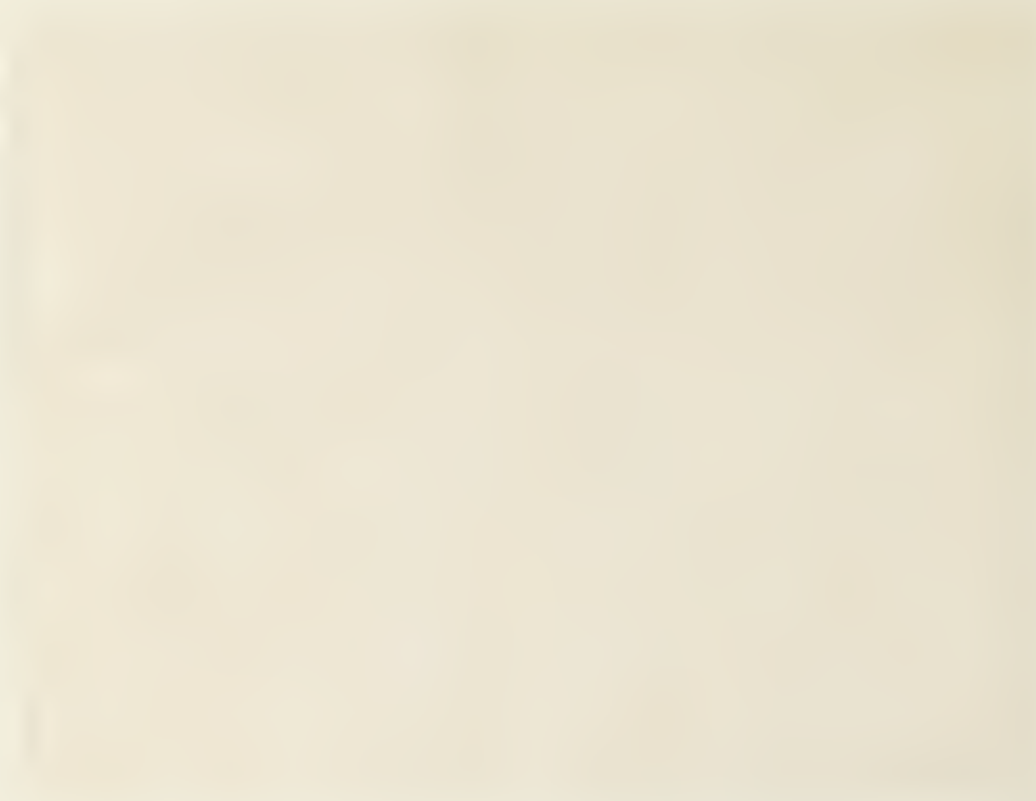


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FIGURE 10 - 8

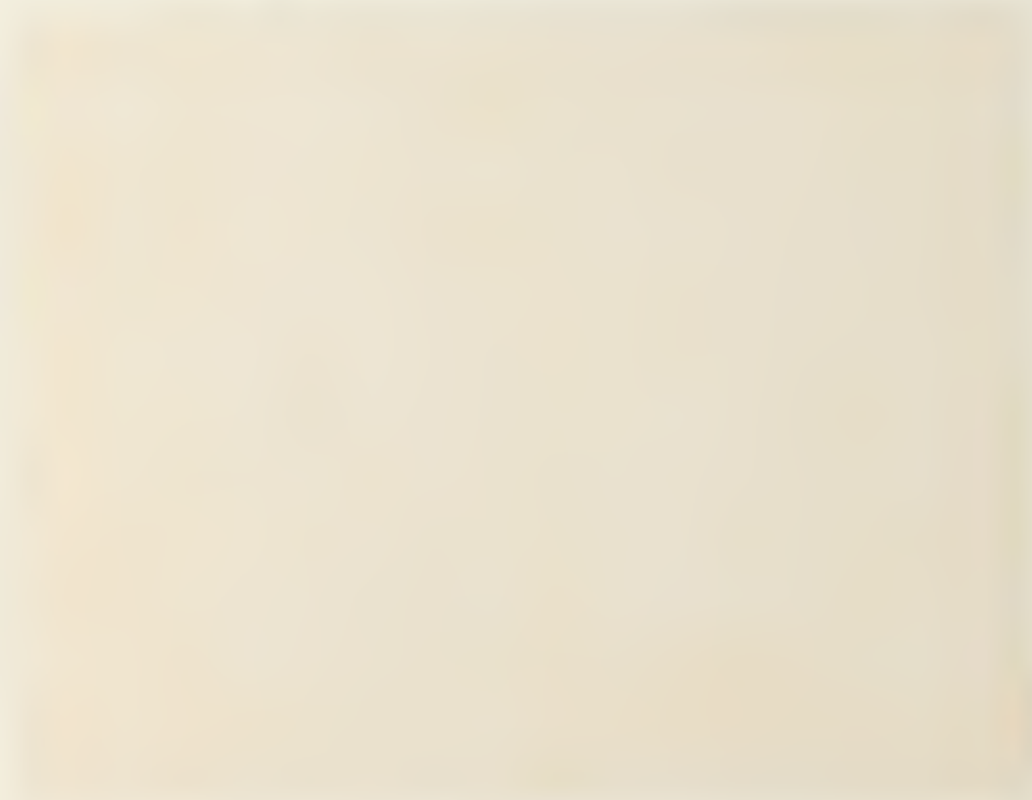
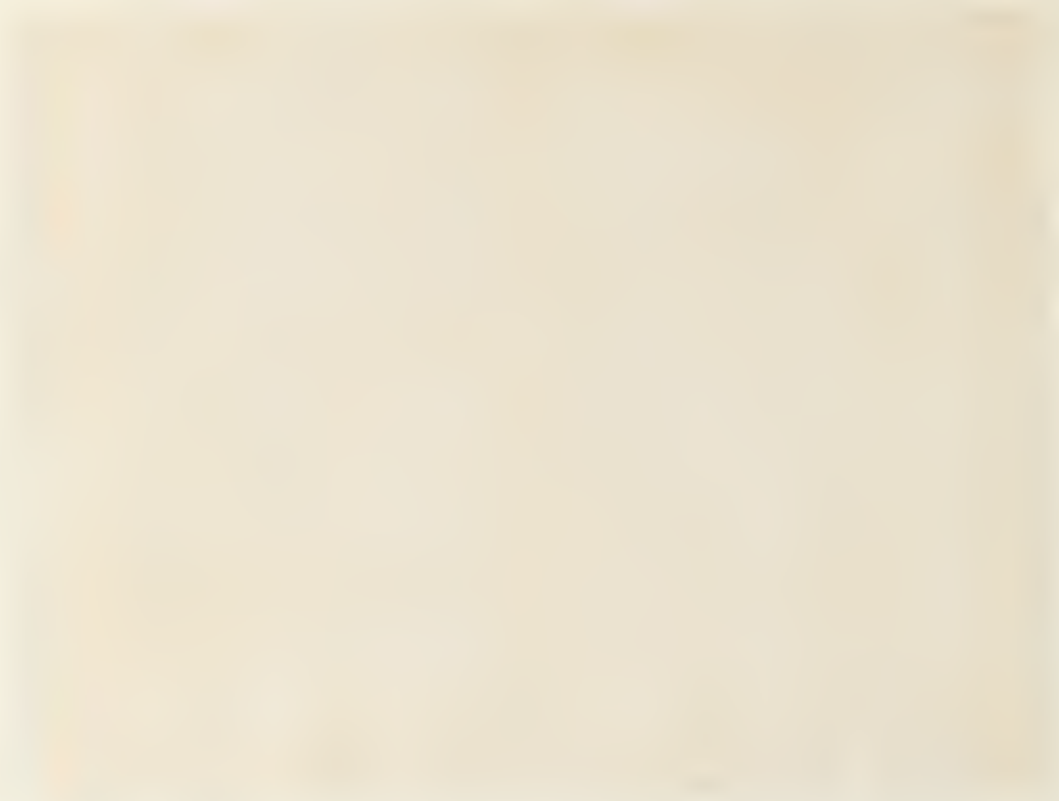


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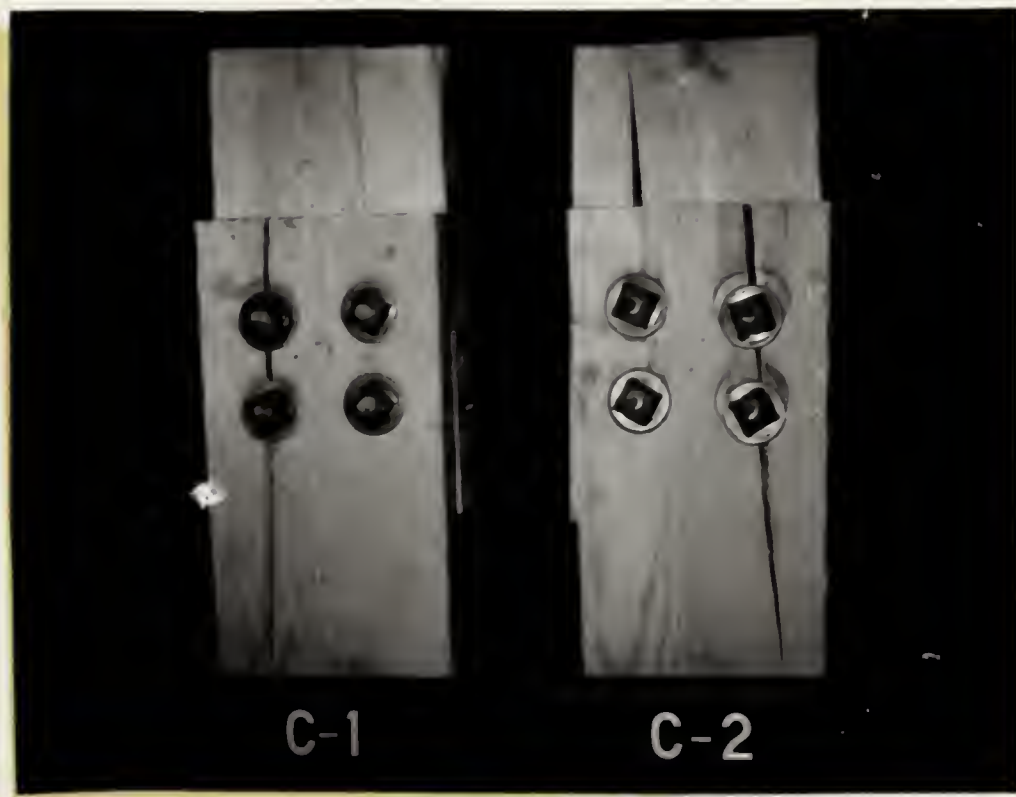
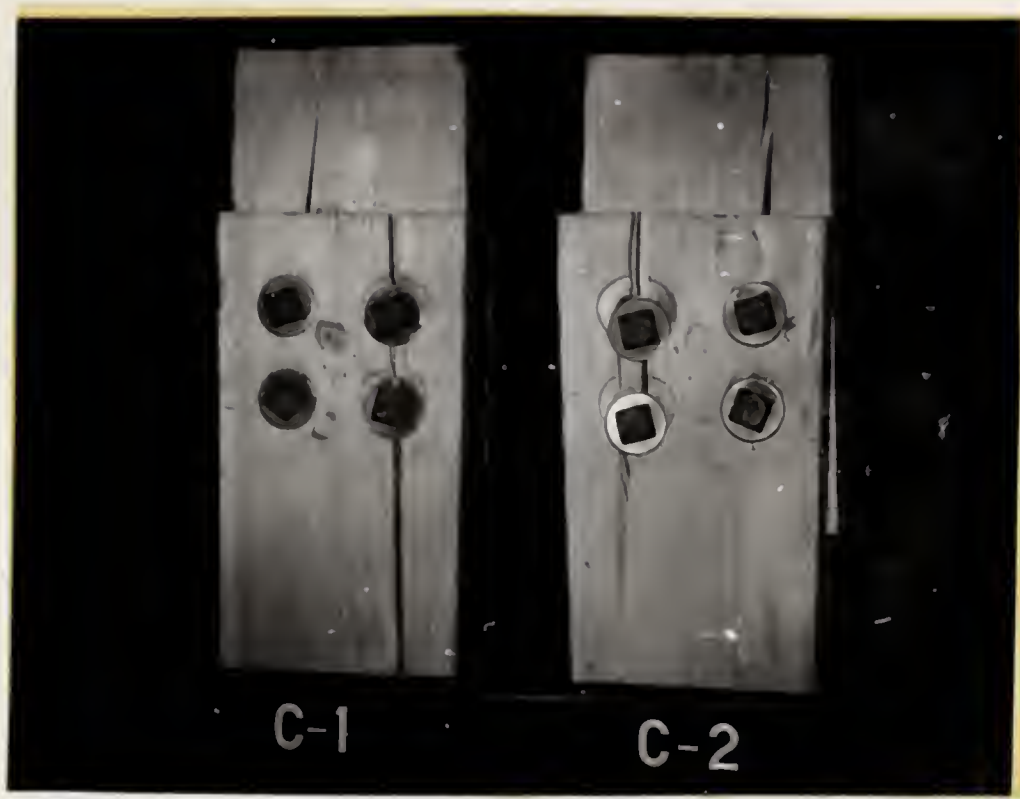


SPECIMENS AFTER TESTING

FIGURE 10 - 9

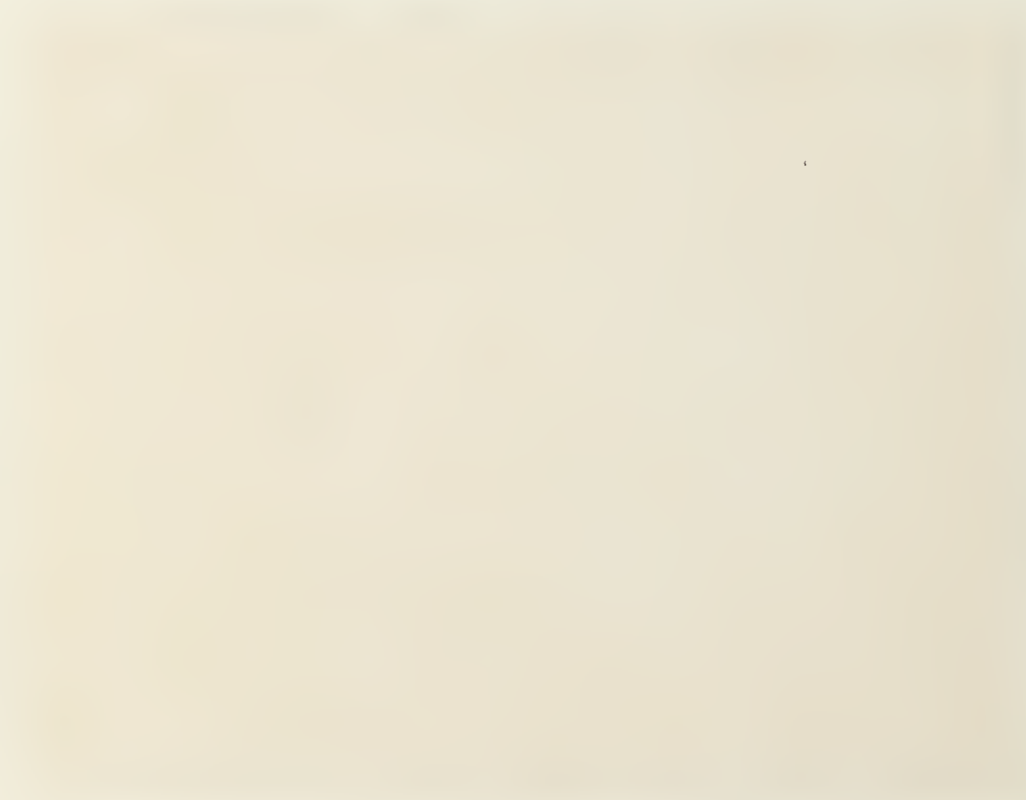


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 BY J. H. B. JONES

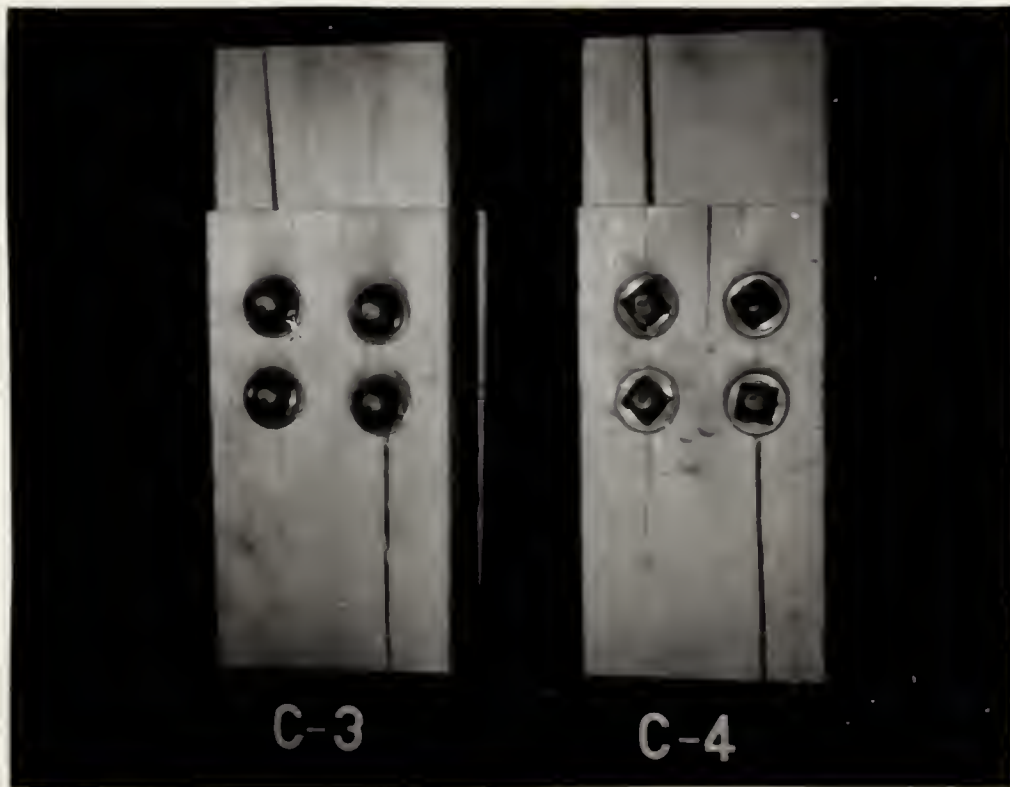
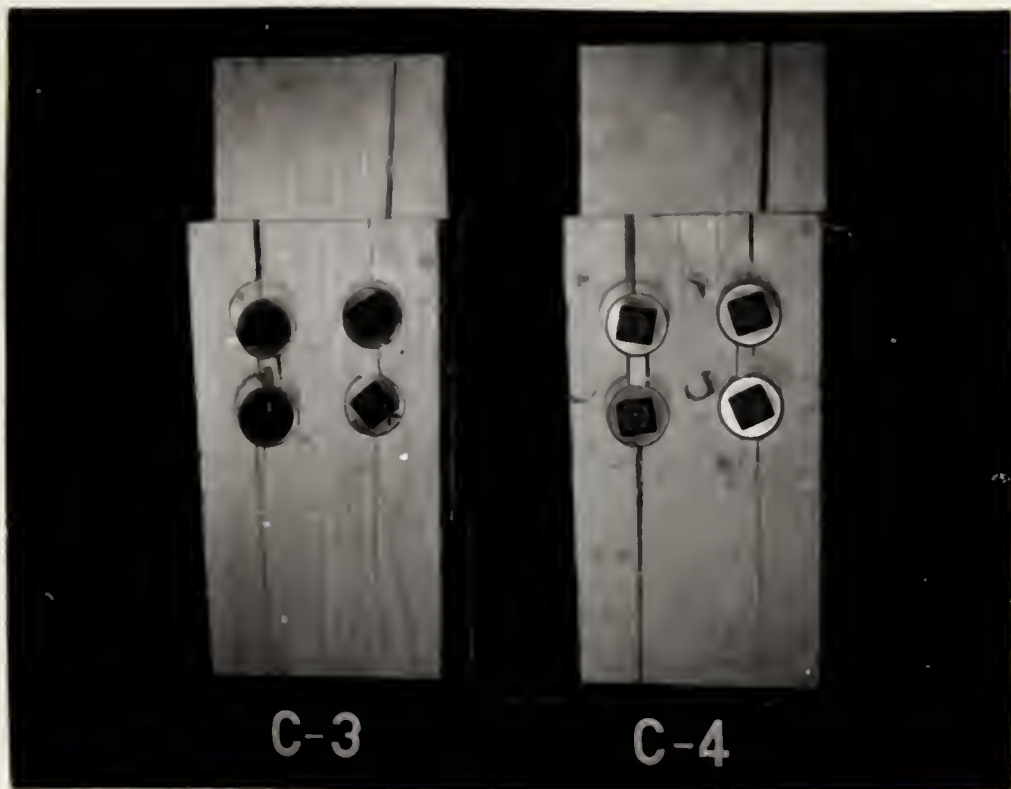


SPECIMENS AFTER TESTING

FIGURE 11 - 1

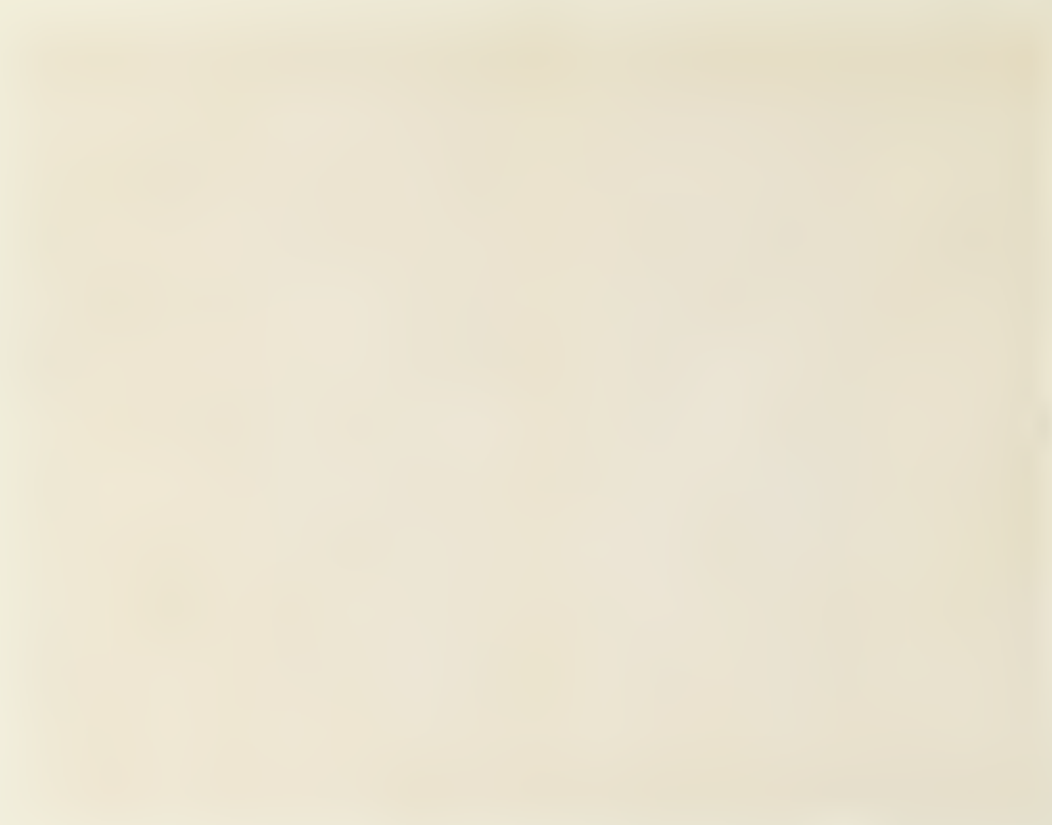


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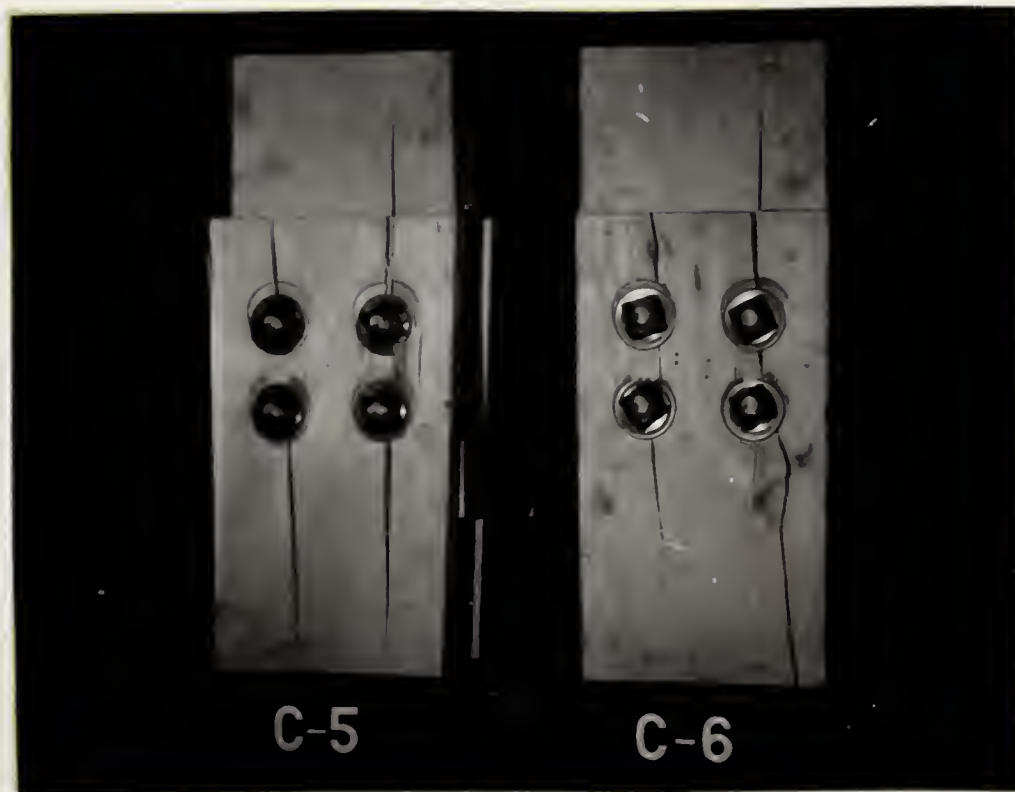
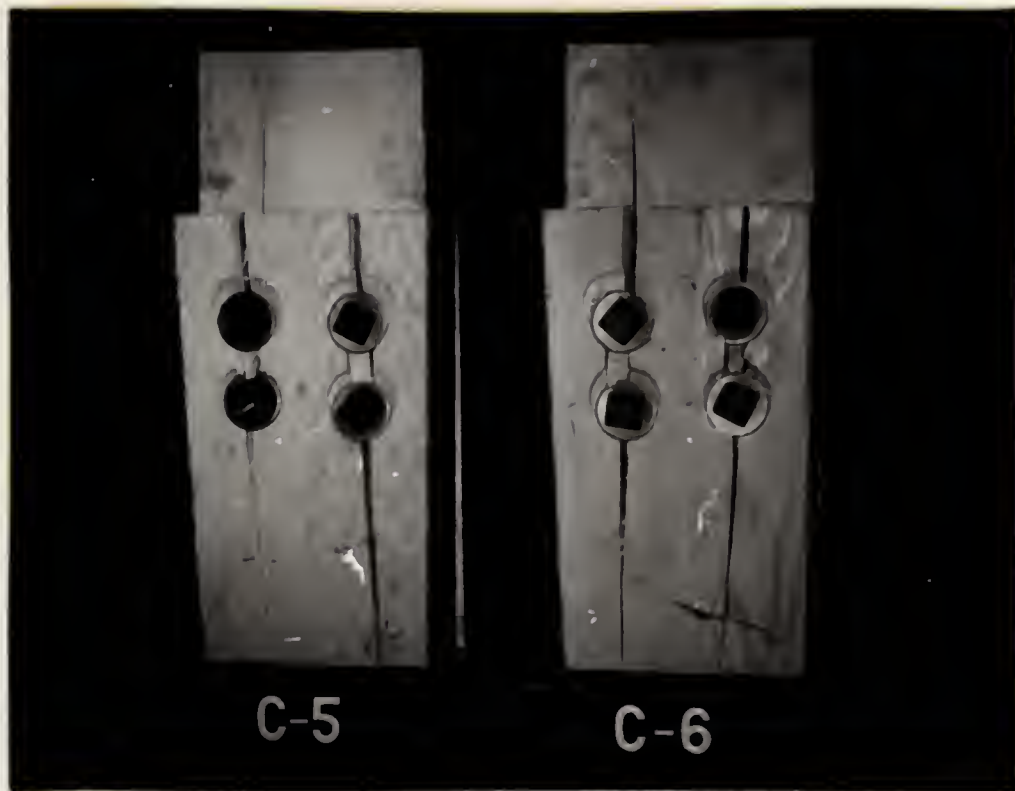
SPECIMENS AFTER TESTING

FIGURE 11 - 2



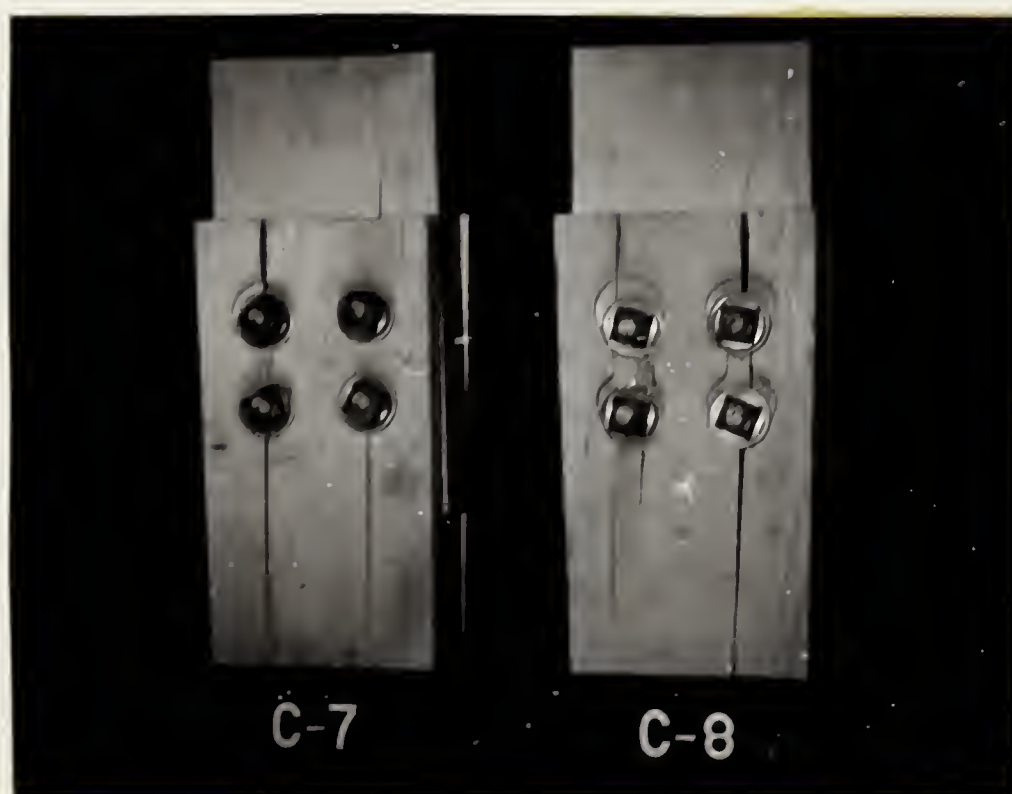
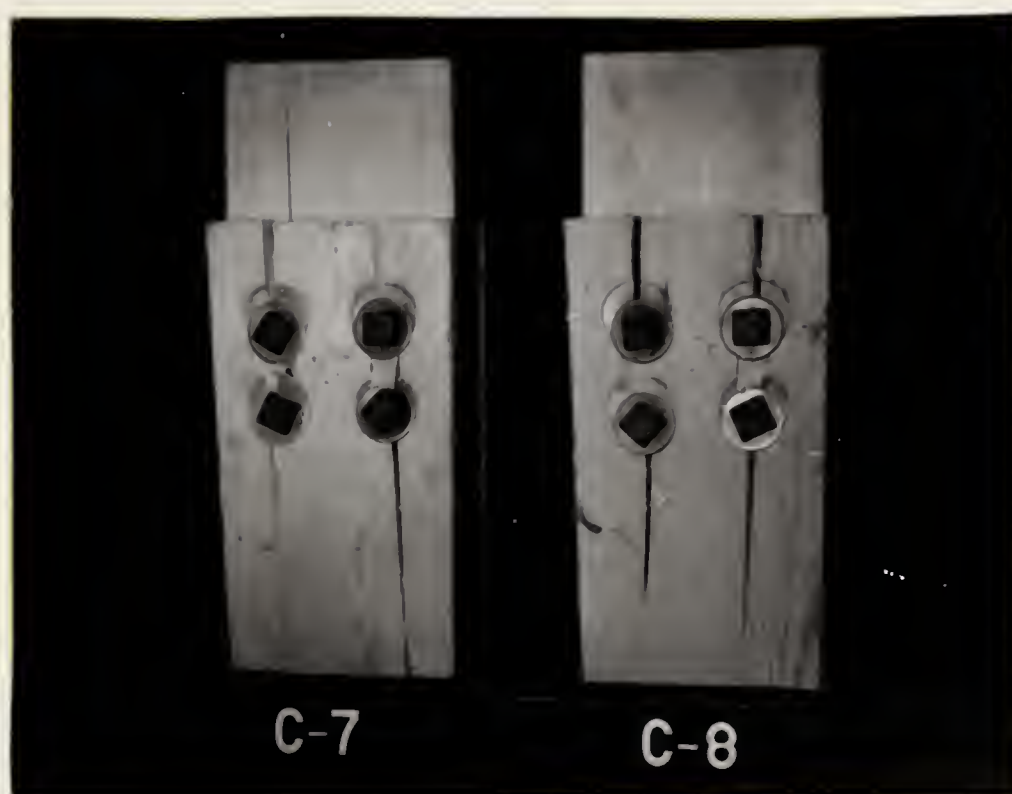
THE END OF THE WORLD

BY J. K. ROWLING



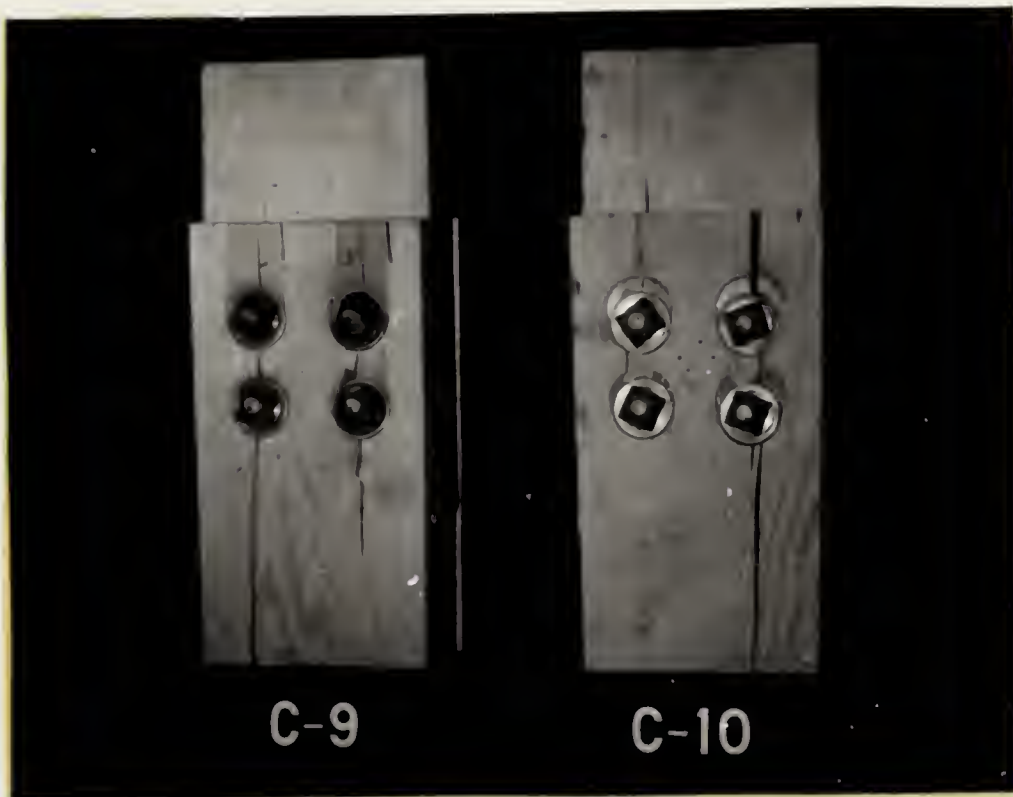
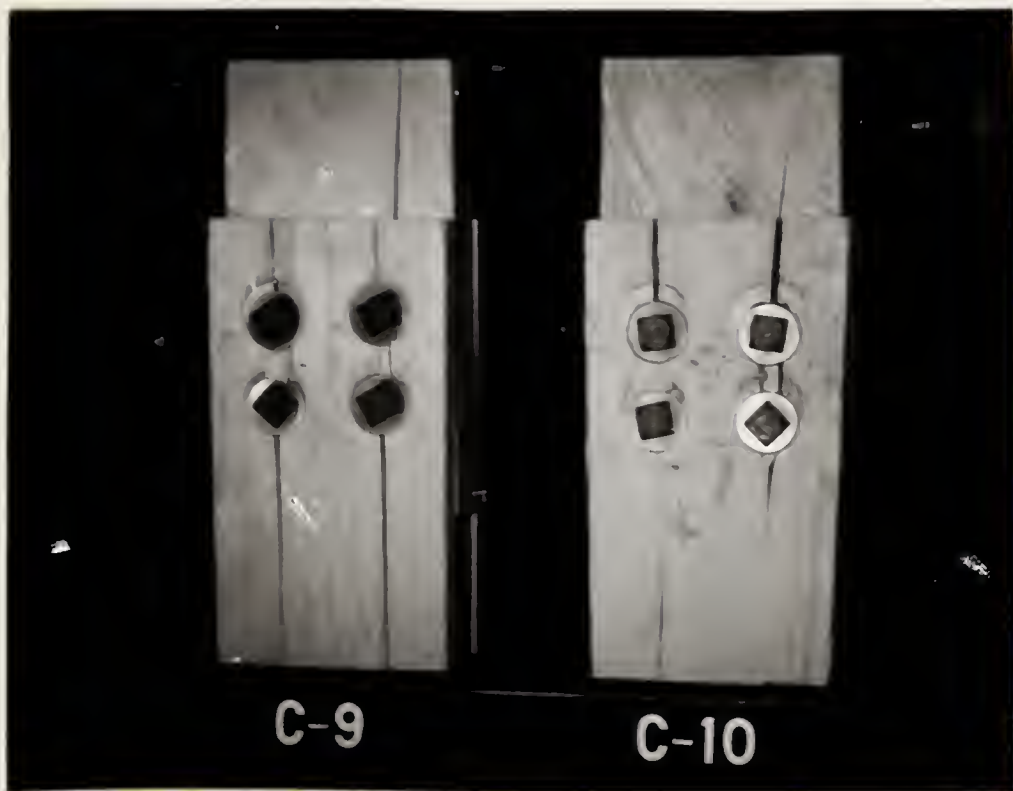
SPECIMENS AFTER TESTING

FIGURE 11 - 3



SPECIMENS AFTER TESTING

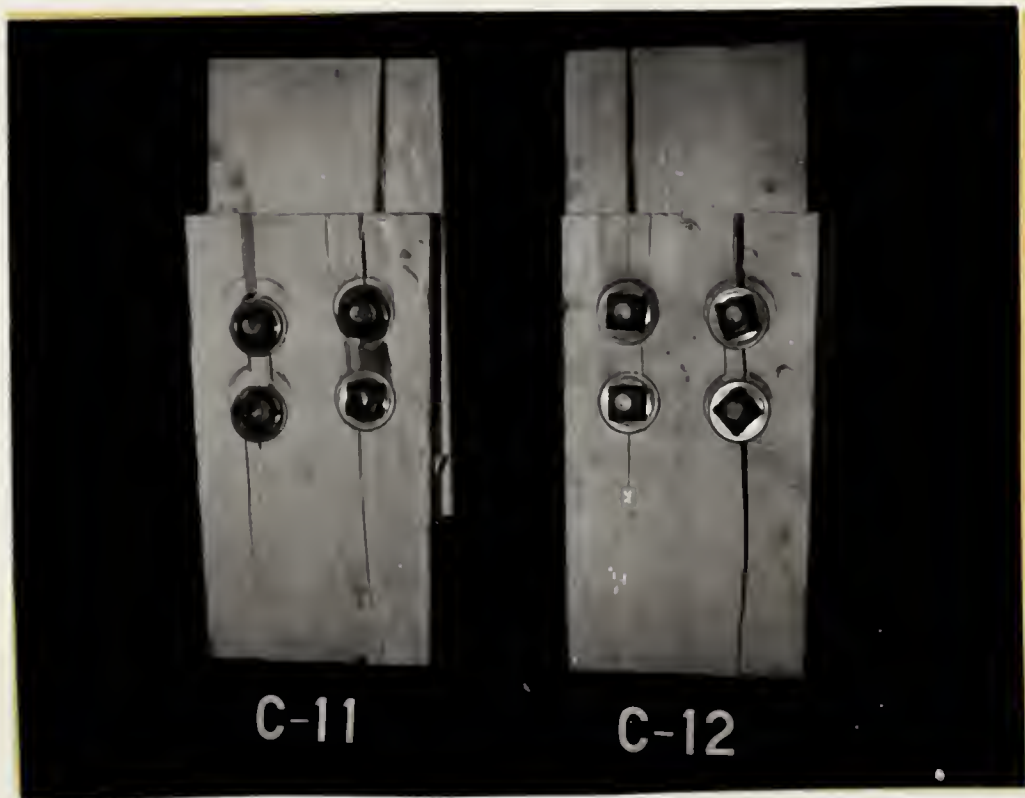
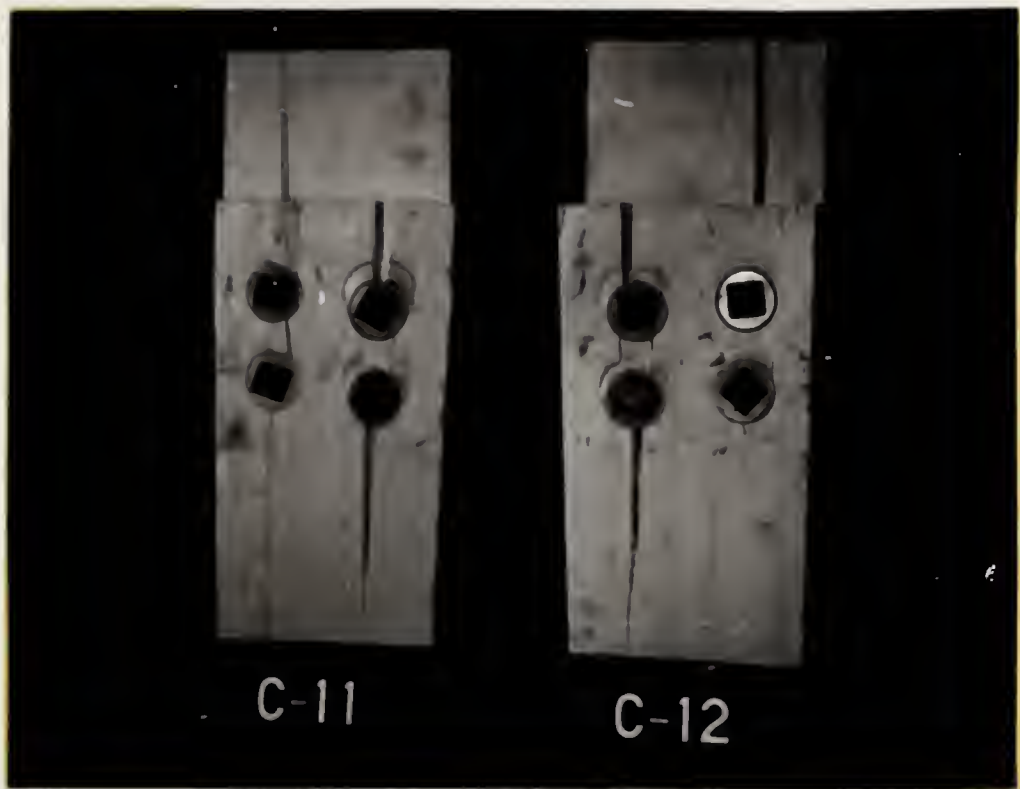
FIGURE 11 - 4



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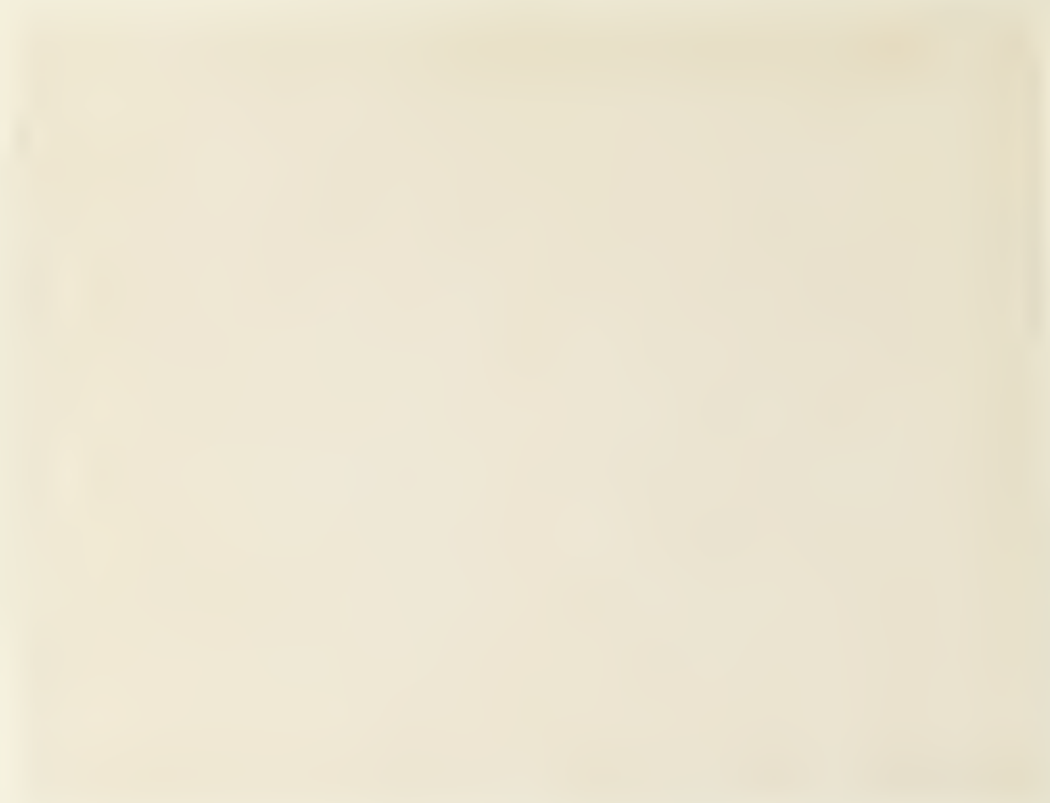
FIGURE 11 - 5



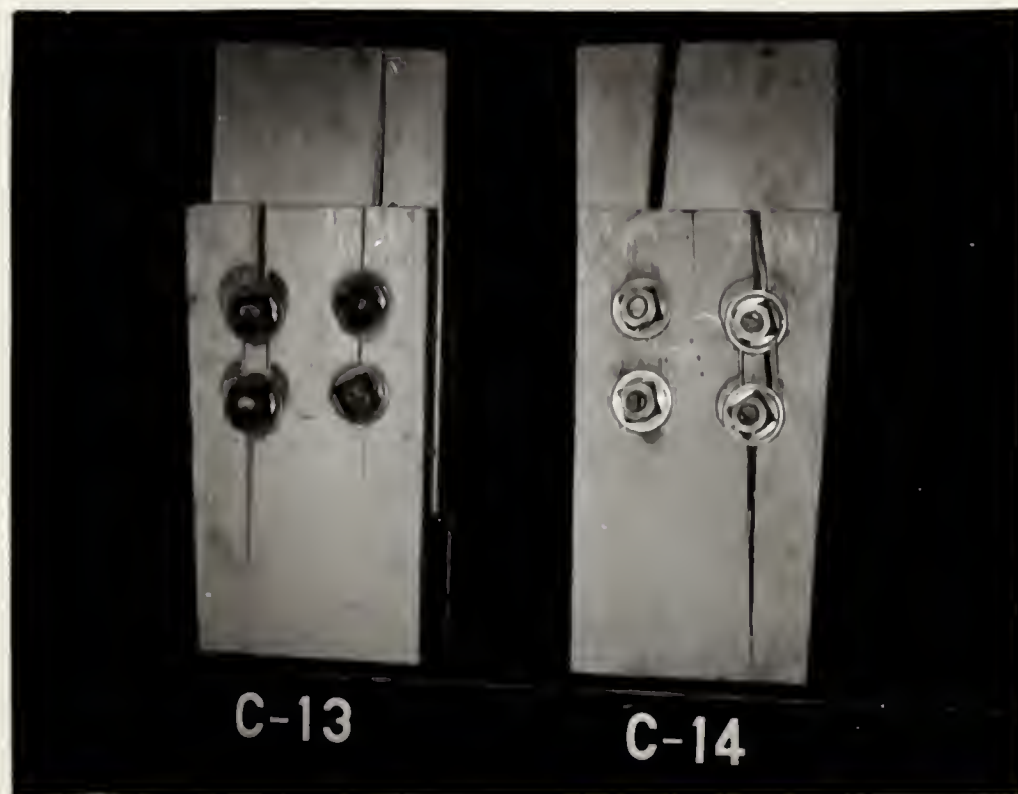
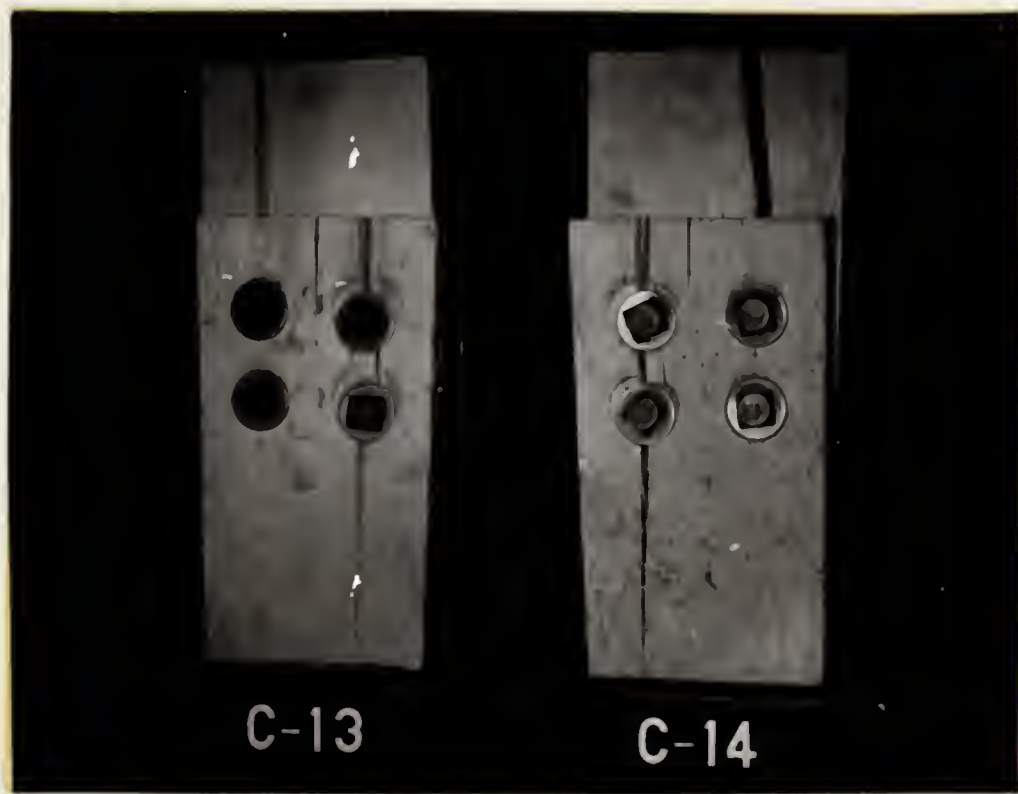


SPECIMENS AFTER TESTING

FIGURE 11 - 6

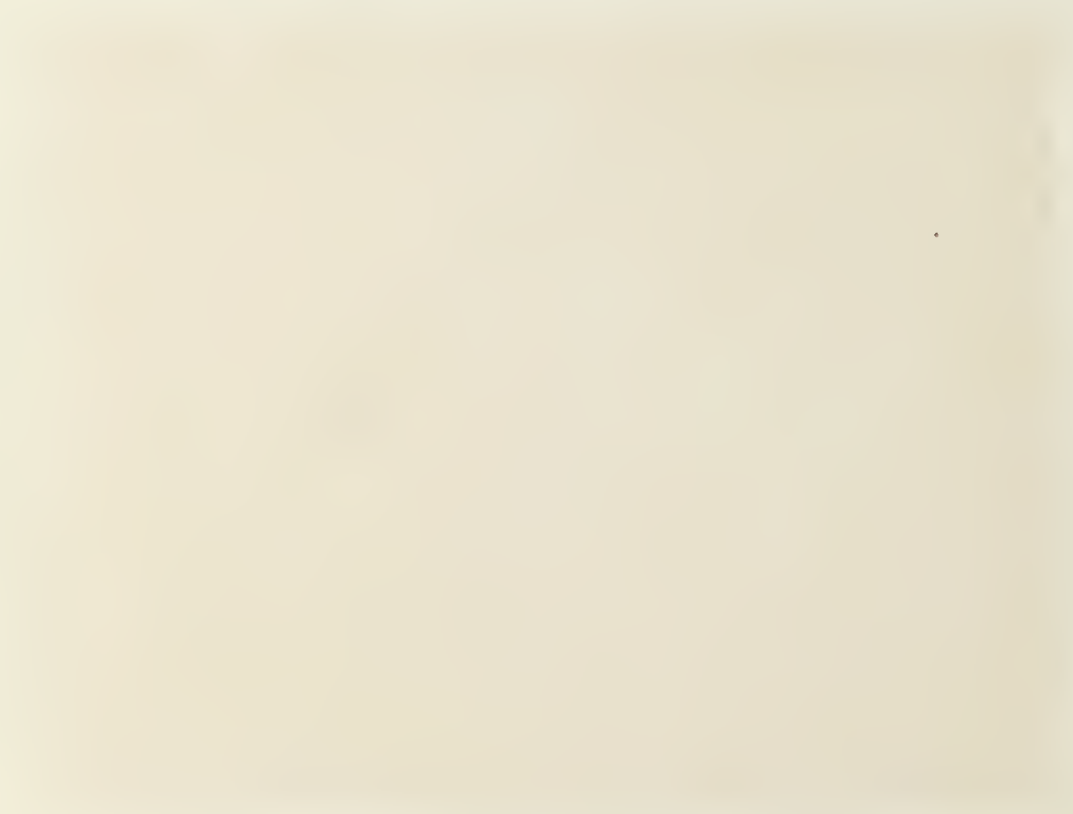
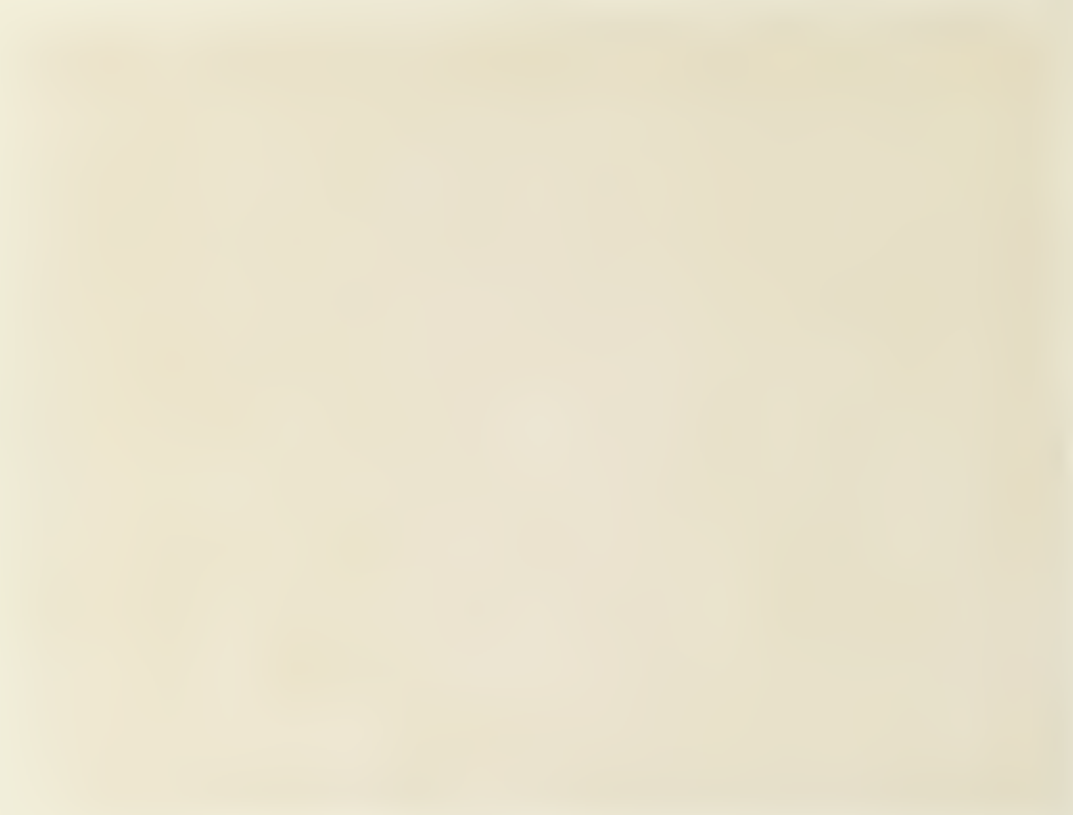


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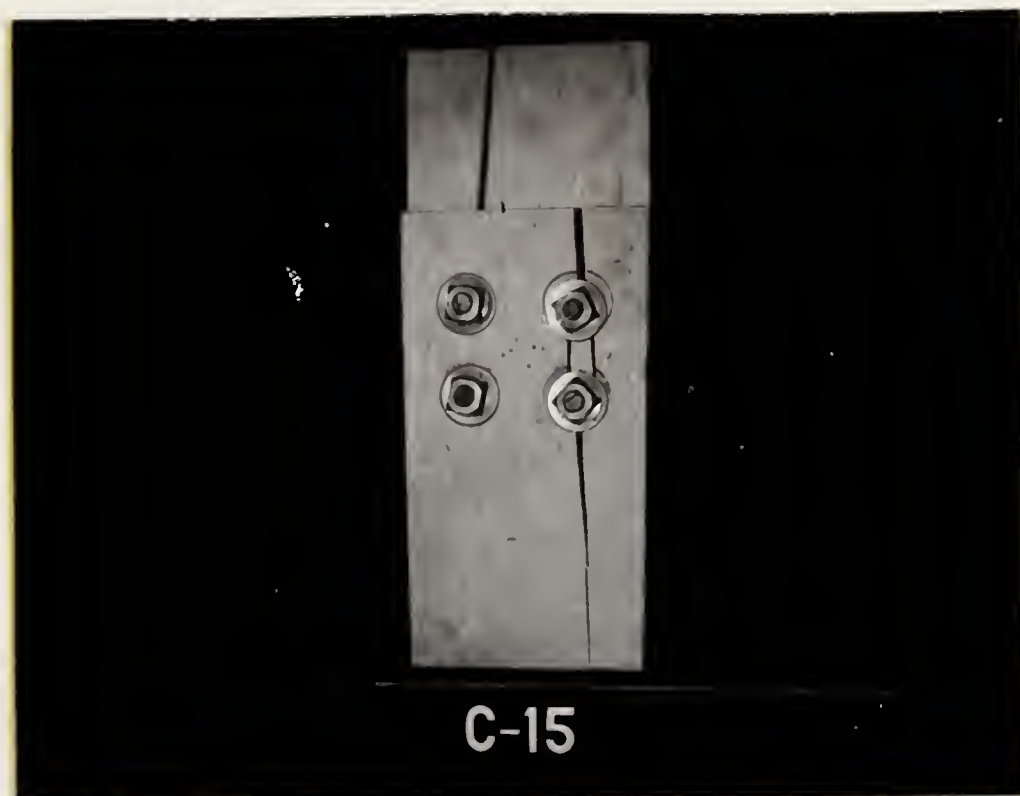


SPECIMENS AFTER TESTING

FIGURE 11 - 7

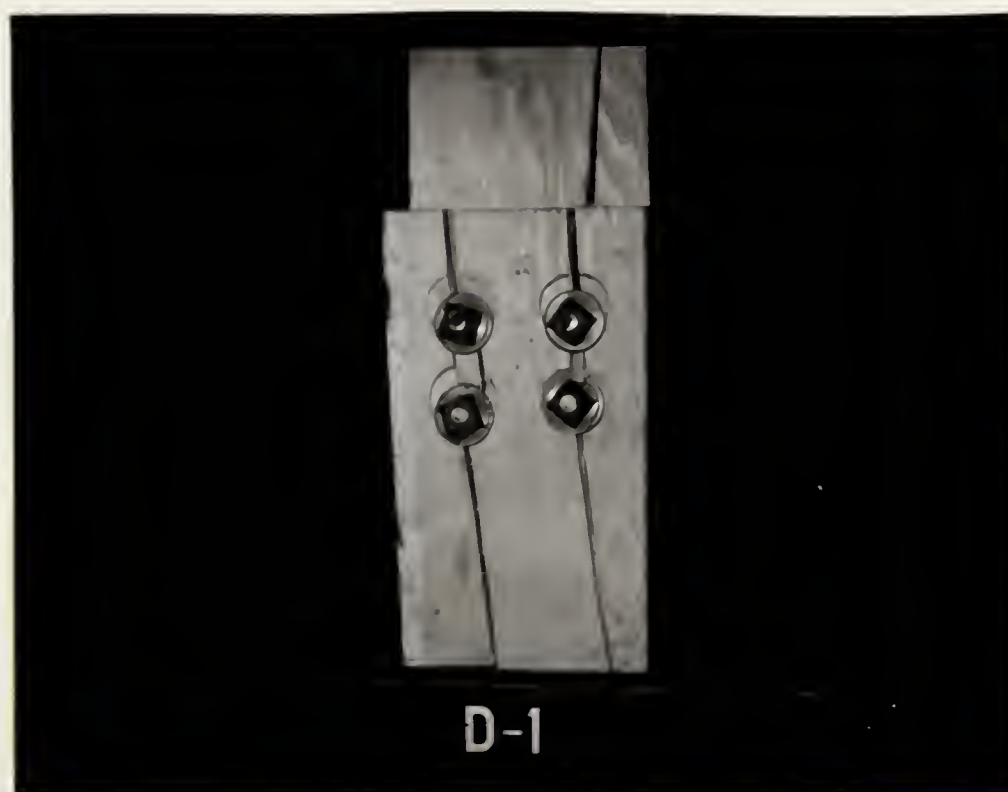


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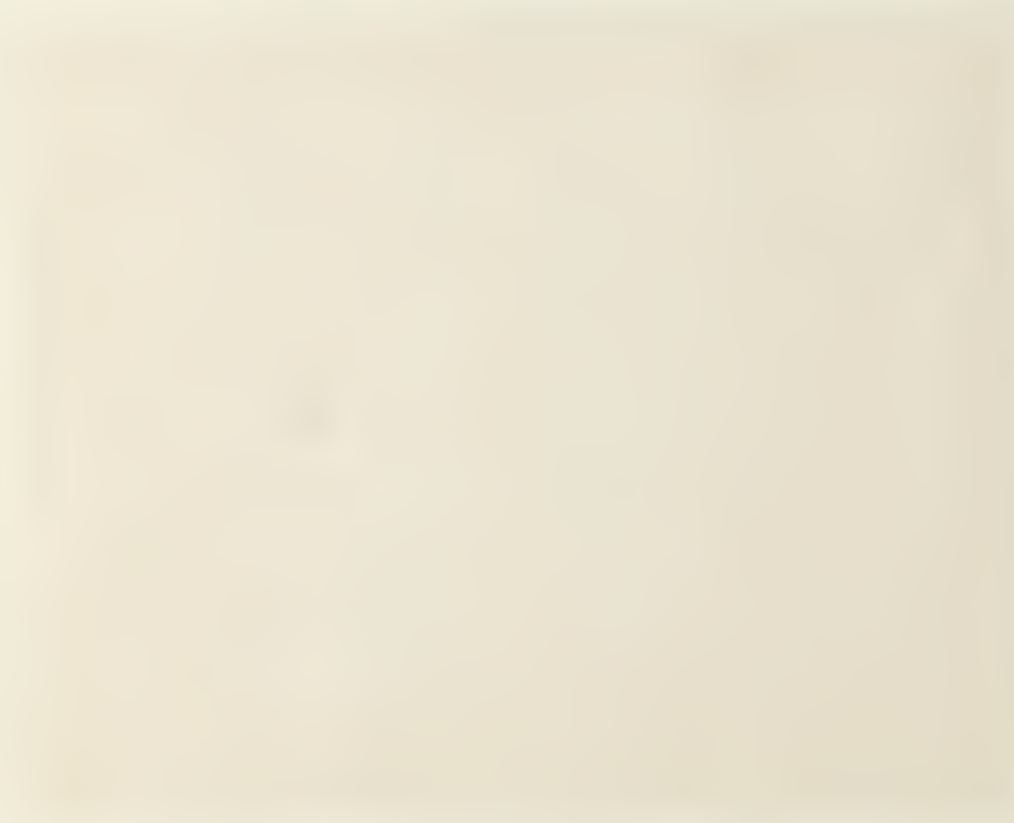
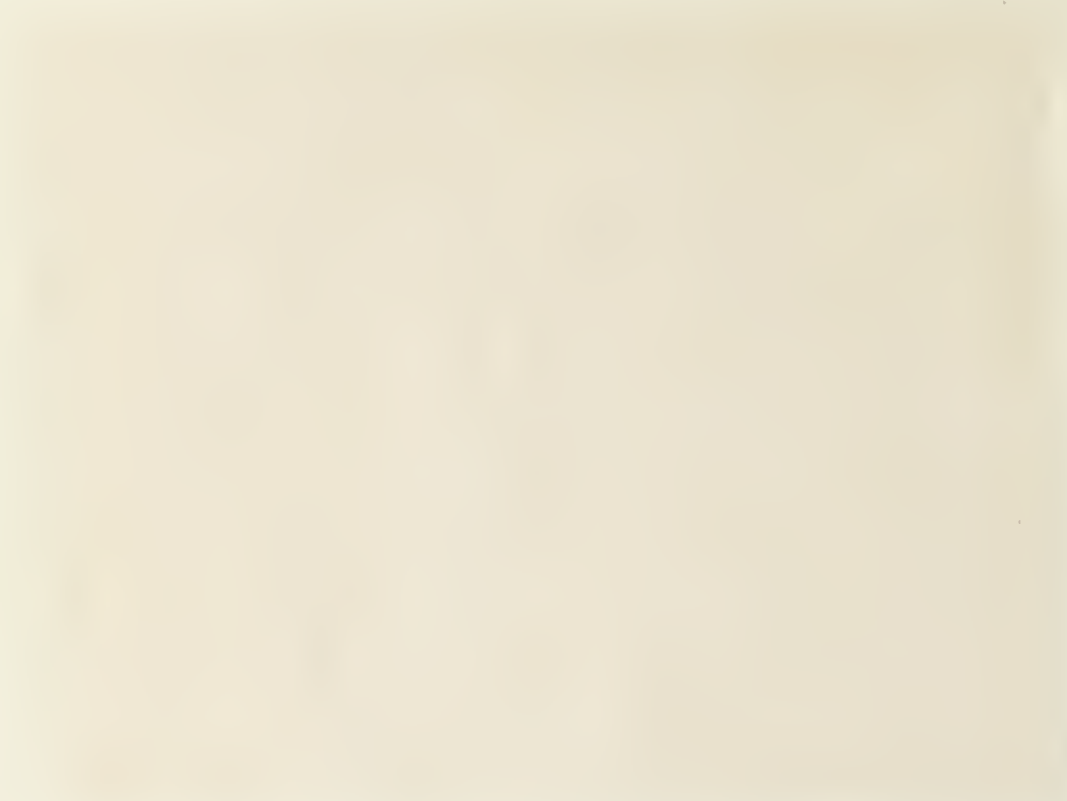
SPECIMENS AFTER TESTING

FIGURE 11 - 8

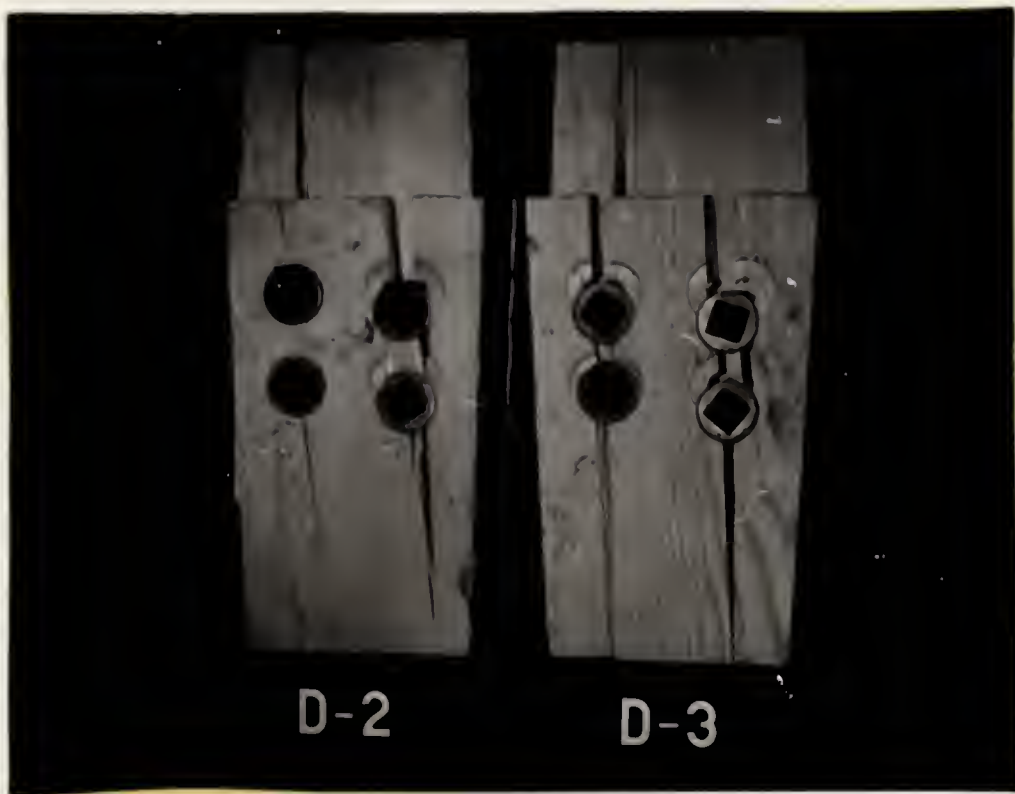


SPECIMENS AFTER TESTING

FIGURE 12 - 1

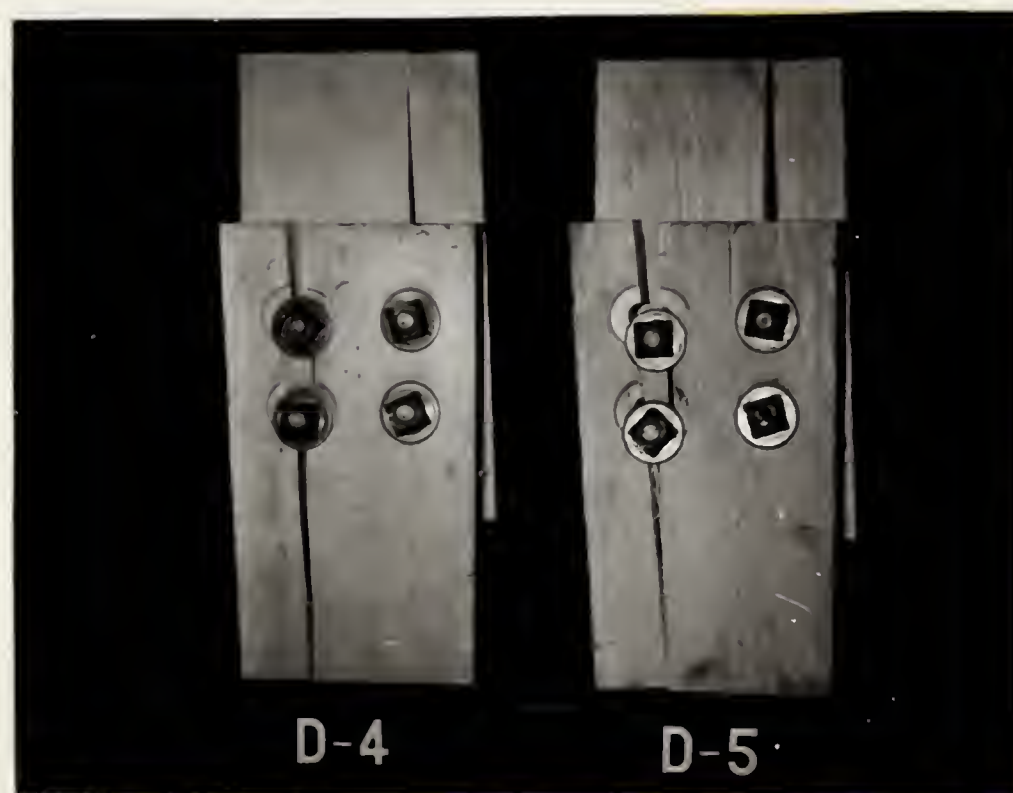
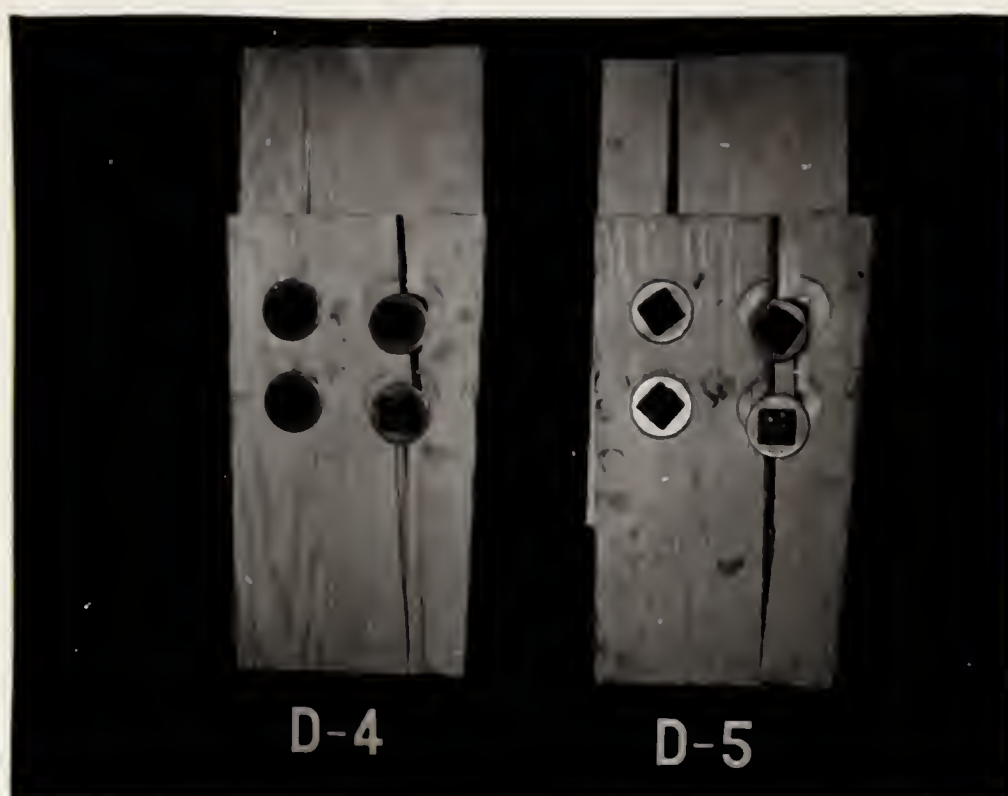


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SPECIMENS AFTER TESTING

FIGURE 12 - 2



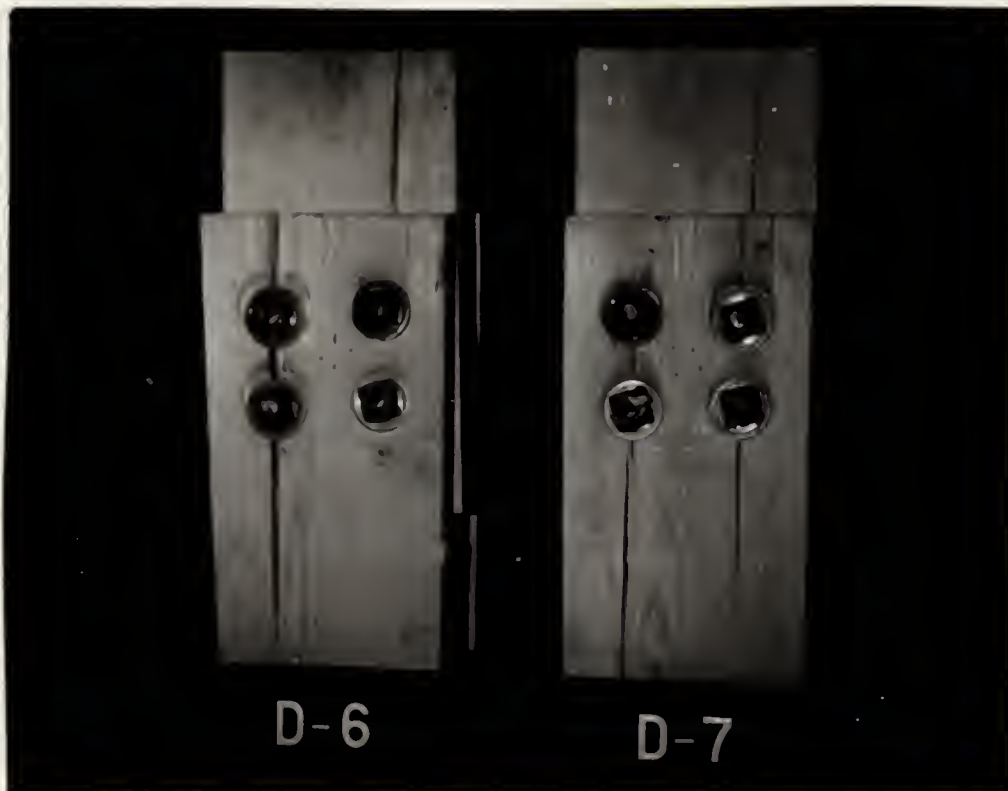
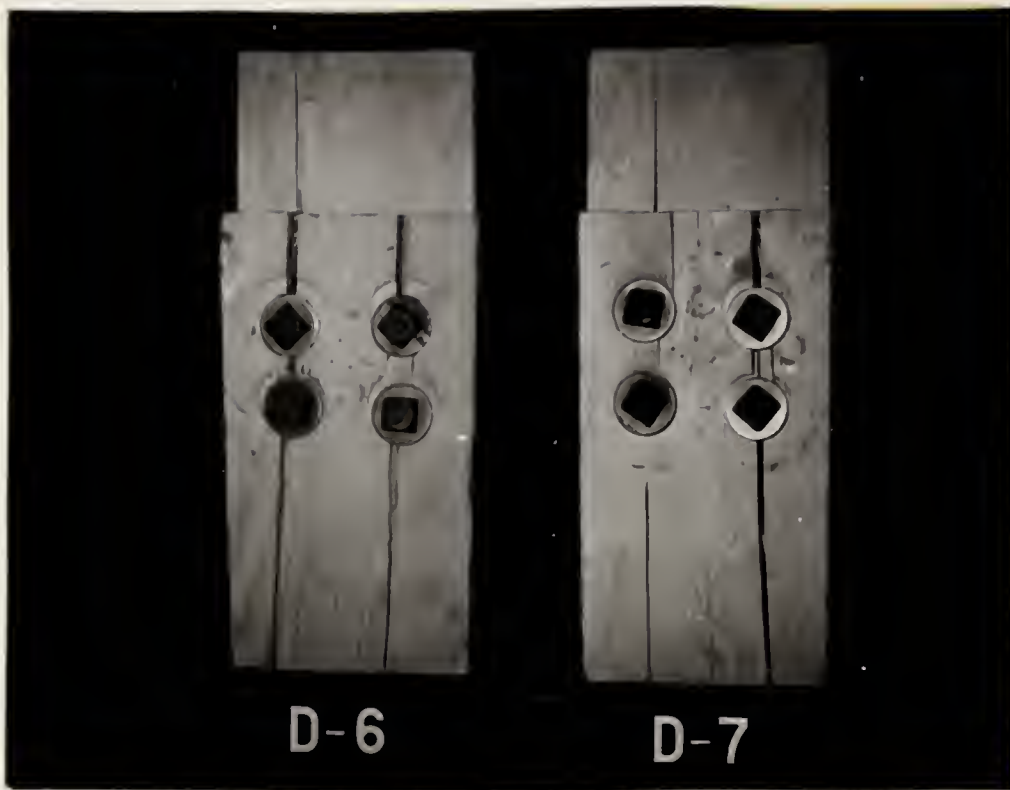
SPECIMENS AFTER TESTING

FIGURE 12 - 3



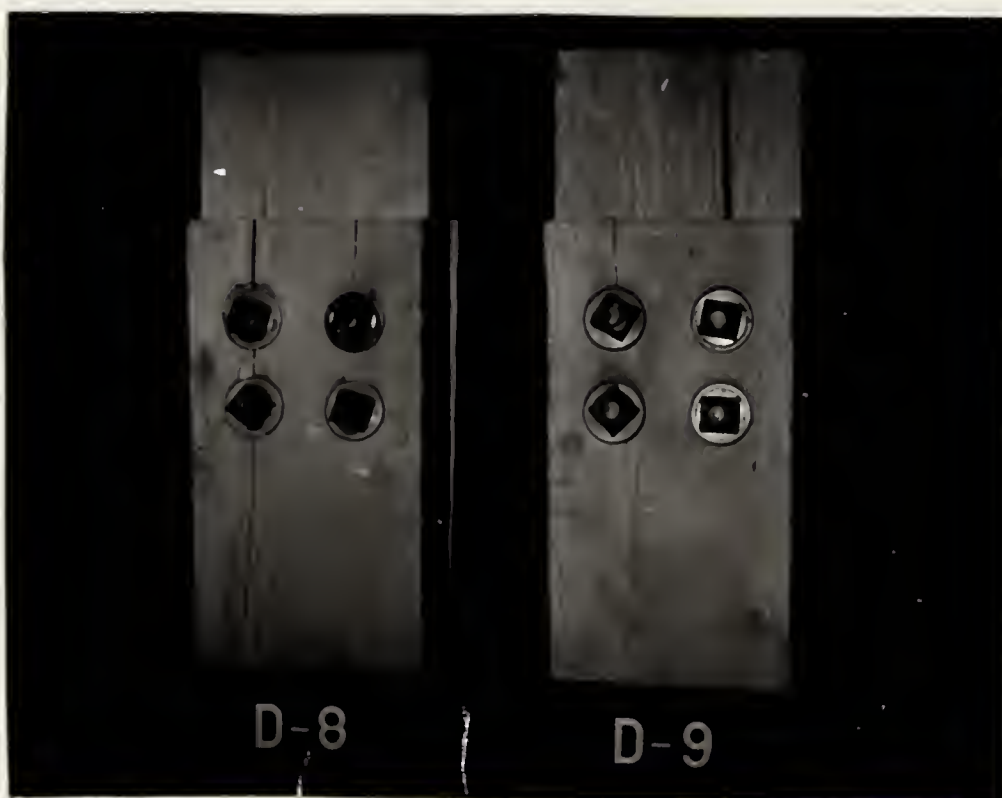
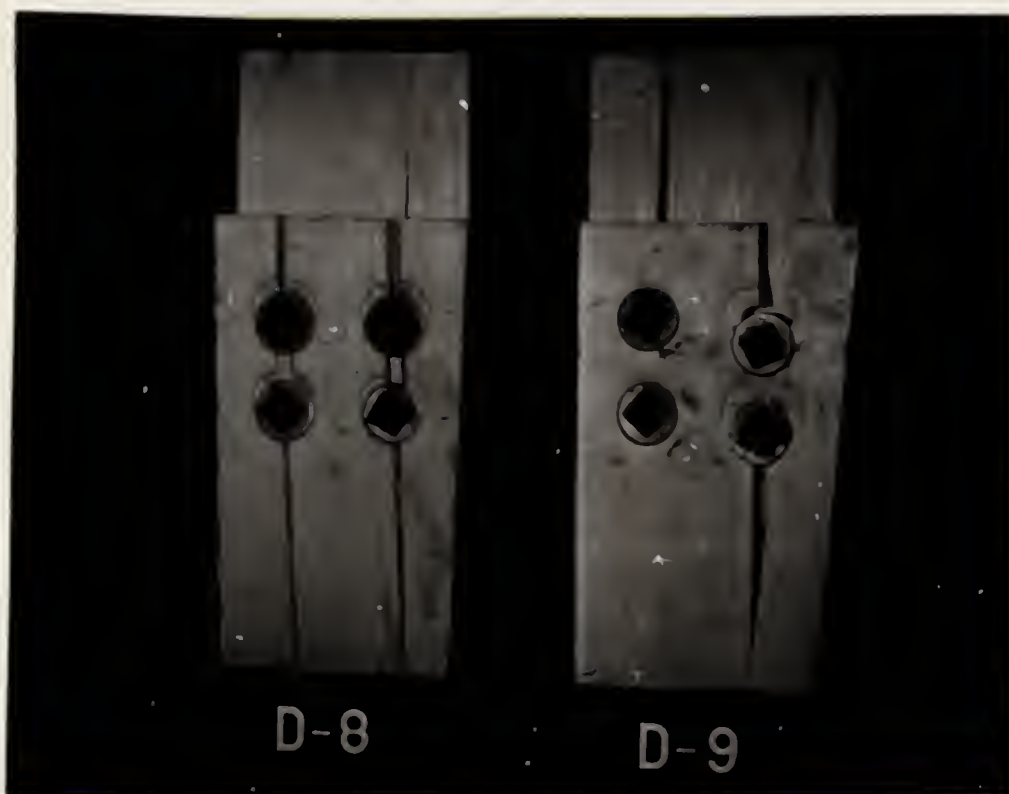
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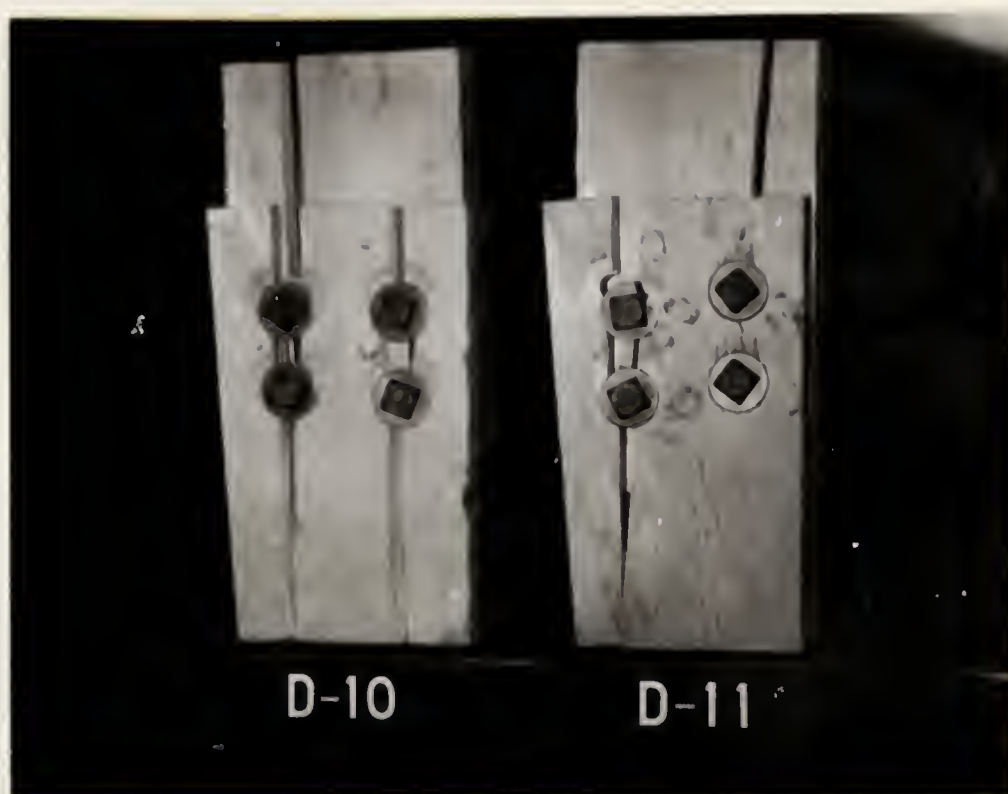
SPECIMENS AFTER TESTING

FIGURE 12 - 4



SPECIMENS AFTER TESTING

FIGURE 12 - 5

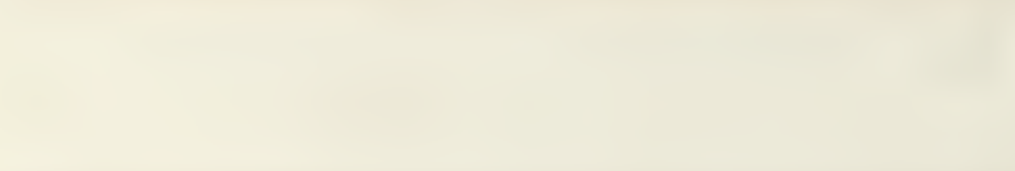


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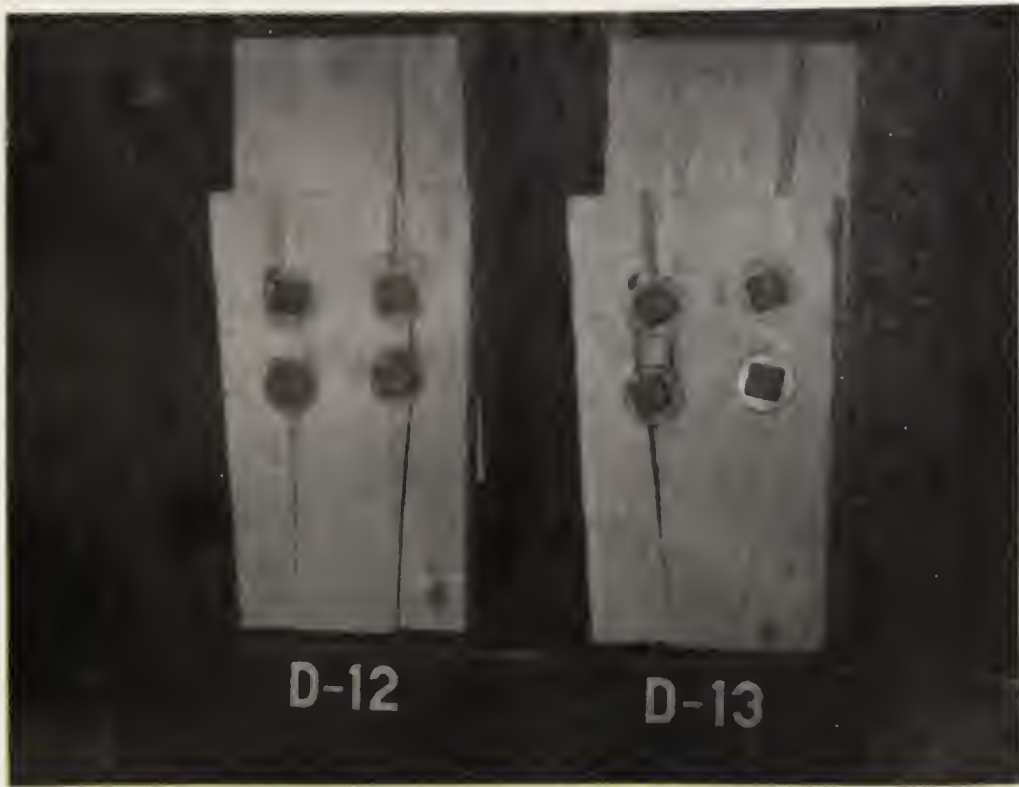
FIGURE 12 - 6



c

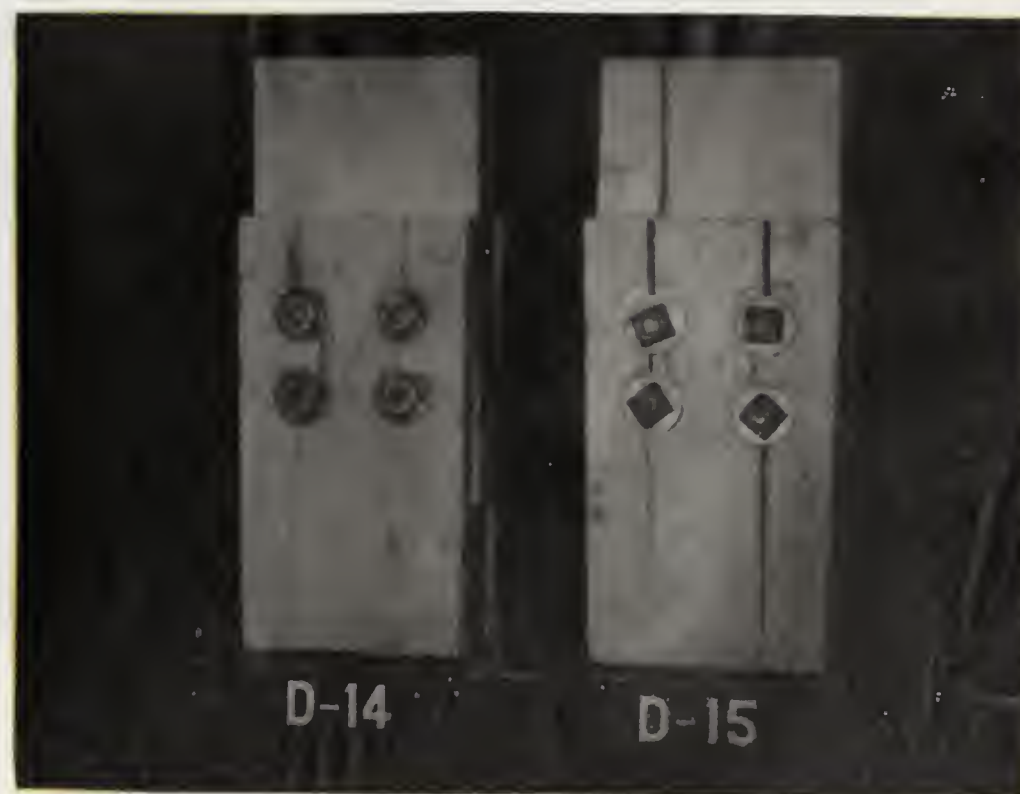
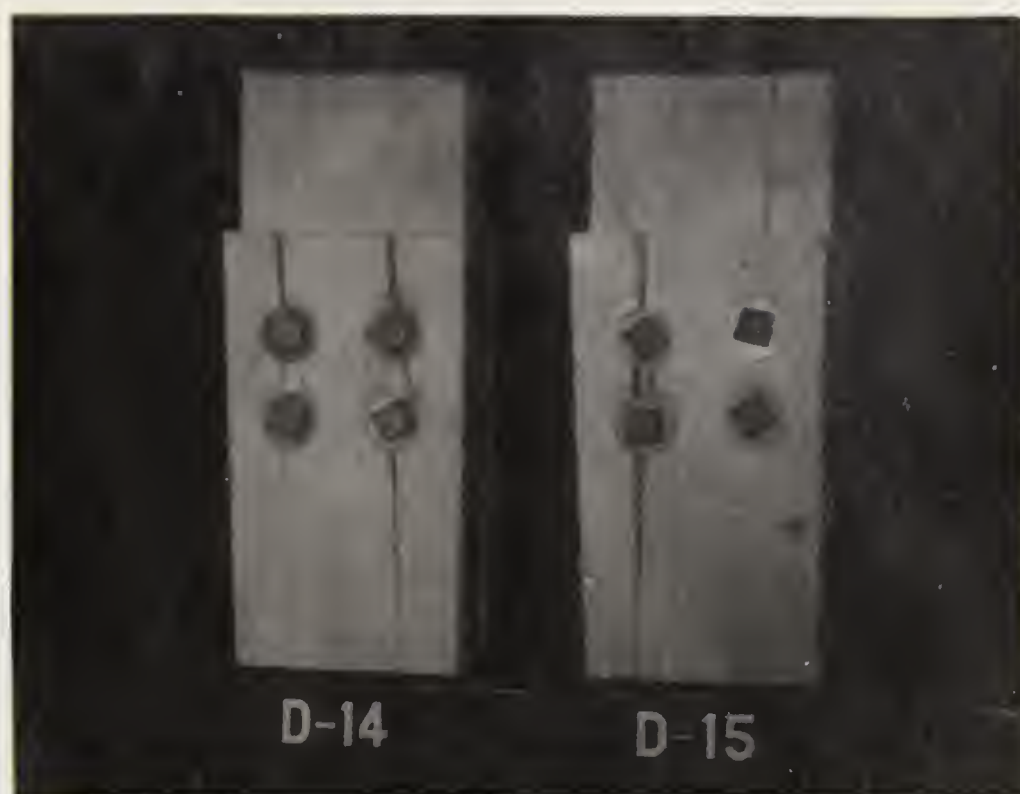


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SPECIMENS AFTER TESTING

FIGURE 12 - 7



SPECIMENS AFTER TESTING

FIGURE 12 - 8



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TYPICAL BOLTS AFTER TEST

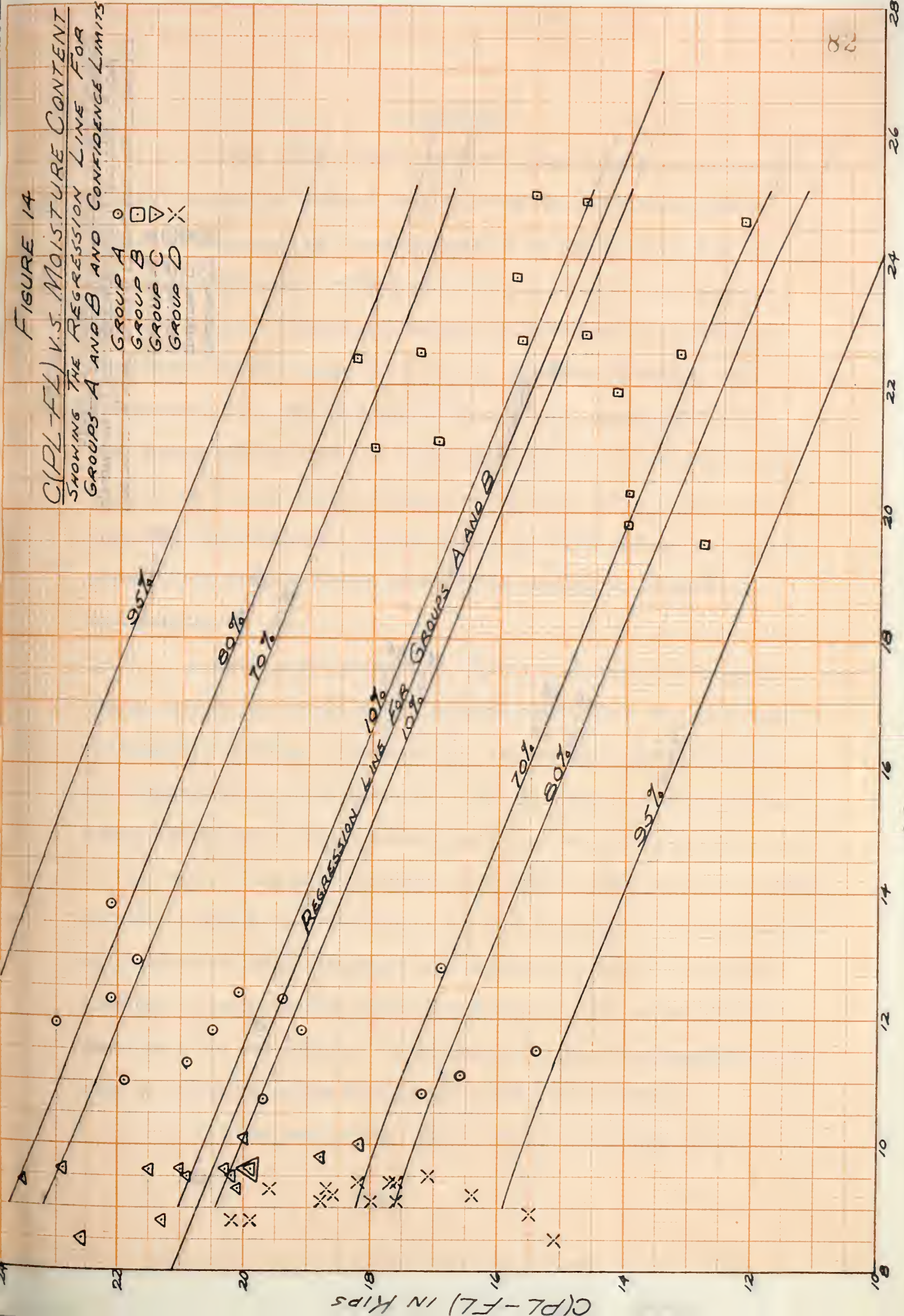
FIGURE 13



FIGURE 14

C(PL-FL) V.S. MOISTURE CONTENT
SHOWING THE REGRESSION LINE FOR
GROUPS A AND B AND CONFIDENCE LIMITS

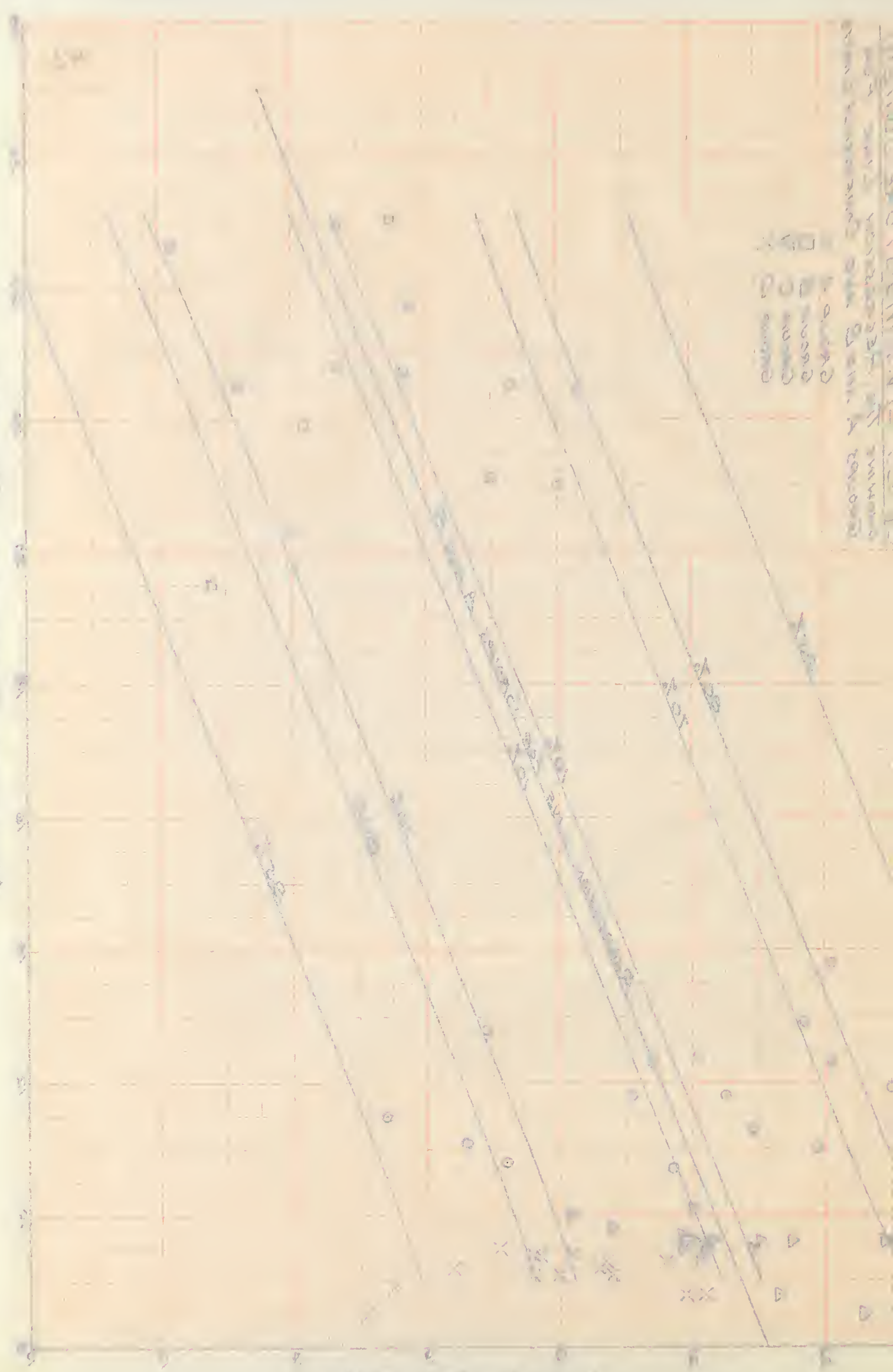
- GROUP A ○
- GROUP B □
- GROUP C ▽
- GROUP D ×



MOISTURE CONTENT IN PERCENT

1. 100%
 2. 90%
 3. 80%
 4. 70%
 5. 60%
 6. 50%
 7. 40%
 8. 30%
 9. 20%
 10. 10%
 11. 0%

100%
 90%
 80%
 70%
 60%
 50%
 40%
 30%
 20%
 10%
 0%



100%
 90%
 80%
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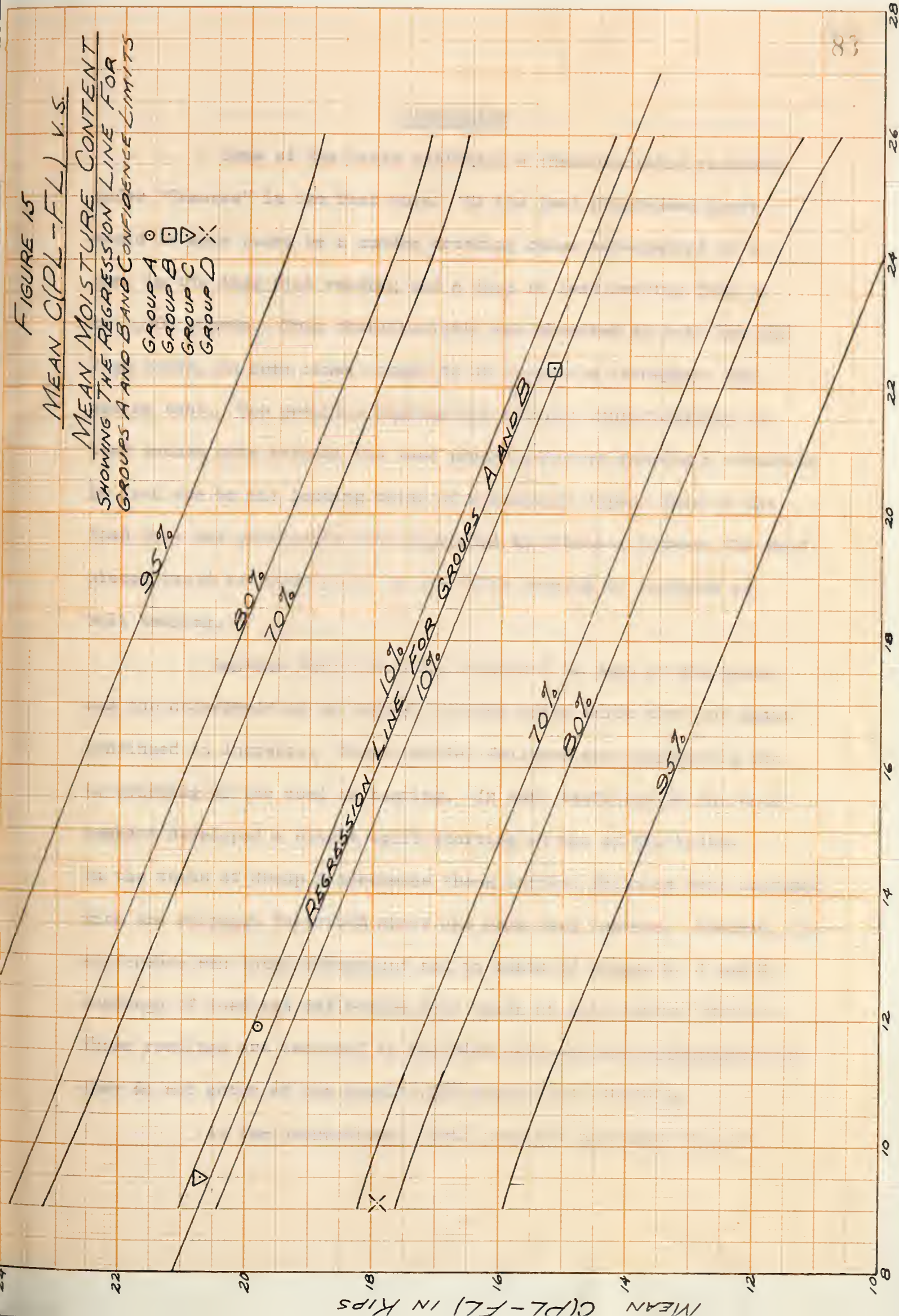
100%
 90%
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 30%
 20%
 10%
 0%

FIGURE 15

MEAN C(PL-FL) V.S.

MEAN MOISTURE CONTENT
SHOWING THE REGRESSION LINE FOR
GROUPS A AND B AND CONFIDENCE LIMITS

- GROUP A ○
- GROUP B □
- GROUP C ▽
- GROUP D ×



MEAN MOISTURE CONTENT IN PERCENT

DISCUSSION

Some of the tests exhibited a characteristic recorded under "Remarks" in the Test Data. As the test progressed there would in some cases be a sudden cracking noise accompanied by a jump in the Ames dial reading and a drop in load varying from 50 to 1,500 pounds. This characteristic was observed at both low and high loads, in some cases occurring at intervals throughout the entire test. One possible explanation of this characteristic is that sudden slip between the wood pieces occurred causing a reduction in load due to the loading being of a reaction type. Some of the load that had previously been supported by friction between the wood pieces would be transferred to the bolts causing an increase in bolt bearing.

Another characteristic exhibited in some of the tests was the occurrence of an initial failure after which the load again continued to increase. These initial failures were apparently due to crushing of the wood in bearing. In some tests one of the wood members developed a slight split starting at one of the bolts. In the tests of Group B specimens these initial failures were confused with the slippage described above and were thus ignored. However, the difference was later recognized and in tests of Groups A, C and D, readings of load and deflection were taken at each initial failure. These readings are recorded in the Test Data and are recognizable as they do not occur at the usual 1,000 pound load intervals.

At the proportional limit load the specimens did not

appear to have sustained any damage. However, when the ultimate load was reached at least one of the wood members of every specimen was split along at least one line of bolt holes due to the wedging action of the bolt. In many cases the section of the member between the bolt holes sheared from the member. The vertical splits at ultimate load were not always as pronounced as indicated by Figures 9 to 12. As previously stated, the loading was sometimes continued beyond the ultimate load until the splits opened up to a greater extent. When the specimens were taken apart it was observed that the fibres under the bolts were thoroughly crushed and the bolts were bent. The amount of bolt bending varied considerably as can be seen in Figure 13.

The proportional limit is used as the basis of allowable loads on bolted joints since under long-time loading, failure would be expected to occur at approximately the proportional limit obtained in a test of short duration (3)(9). The proportional limit is generally defined as that point on the load-deflection curve at which there is a definite departure from a linear relationship. However, in this investigation, as in several other investigations, the departure of the curve from a straight line was usually so gradual that the exact limit of proportionality was difficult to establish (10)(11). This was probably partly due to the fact that, because of inevitable variables, it is very unlikely that the proportional limit loads under all the bolts would be reached simultaneously. The selection of the proportional limit is further complicated by the fact that the

initial portion of the load-deflection curve may be composed of two or three straight line segments of slightly different slopes. This was actually the case for several specimens in this investigation and has been observed in other investigations (11).

For the purposes of defining the proportional limit in this investigation, the slope of the straight portion of the load-deflection curve was determined. The proportional limit was then defined as the last load which did not depart from this straight line by more than 0.0015 inches. The proportional limit load for Group C specimens was fairly well defined and could be determined by inspection of the load-deflection curves. It was found that when the offset method described above was used, the proportional limit load so obtained corresponded very well to the proportional limit load obtained by inspection of the load-deflection curves. For this reason the proportional limit load of all specimens was determined by using an offset of 0.0015 inches. In cases where the initial portion of the load-deflection curve was composed of two or more straight line segments the last segment was used.

As can be seen from Figures 5 to 7, friction plays an important part in the action of a joint. In all specimens, except those in Group D, some load was taken by friction alone before any was taken by bolt bearing. Generally, the loading proceeded with very little slip occurring until a certain load was reached. At this load a clearly defined increase in slip occurred which produced a drop in load due to the loading being of a reaction type. The load

the first of these is the fact that the
 the second is the fact that the
 the third is the fact that the

the fourth is the fact that the
 the fifth is the fact that the

the sixth is the fact that the
 the seventh is the fact that the

the eighth is the fact that the
 the ninth is the fact that the

the tenth is the fact that the
 the eleventh is the fact that the

the twelfth is the fact that the
 the thirteenth is the fact that the

the fourteenth is the fact that the
 the fifteenth is the fact that the

the sixteenth is the fact that the
 the seventeenth is the fact that the

the eighteenth is the fact that the
 the nineteenth is the fact that the

then fluctuated considerably until the bolts came into bearing on the wood, whereupon the rate of deflection slowed and the load began to increase more uniformly. This phenomenon did not occur in the tests of specimens in Group D since the nuts were loose enough before the tests to be easily turned with the fingers. In order to compare the bolt bearing strengths of the specimens an attempt has been made to eliminate that part of the strength of the specimens due to friction. The friction load has been defined as the load required to produce initial slip. This is not quite accurate since this friction load would be the static friction load whereas the friction load that was in effect throughout the test would be the dynamic friction load. This friction load, as determined from Figures 5 to 8, has been subtracted from the proportional limit load and the ultimate load in order to obtain the corresponding loads sustained by bolt bearing only.

In order to compensate for the effect of variation of specific gravity on the crushing strength of the wood, the values obtained in the tests were adjusted by the use of the formula:

$$\frac{S}{S^1} = \left(\frac{g}{g^1} \right)^n$$

where S = property at specific gravity g

S^1 = property at specific gravity g^1

$n = 1.25$ for bolts bearing parallel to the grain.

This formula was applied to the results of each test to obtain the corrected value of the difference between the proportional limit load and the friction load and the corrected value of

the difference between the ultimate load and the friction load (Columns 7 and 11, Table 2). All values were corrected to a constant specific gravity of 0.48 which is the average for Douglas fir.

Figure 14 is a plot of corrected values of the difference between the proportional limit load and the friction load versus moisture content. The regression line (best fit straight line) and confidence limits for Groups A and B have also been plotted. The methods used in the computations for the regression line and the confidence limits are outlined in Appendix A.

Figure 15 is a plot of mean corrected values of the difference between the proportional limit load and the friction load versus mean moisture content for each group together with the regression line and confidence limits.

In Appendix A it is shown that the slope of the regression line is significant, i.e. an increase in moisture content is accompanied by a decrease in the proportional limit load of bolted joints. The equation for determining the proportional limit load of a bolted joint of the same type tested in this investigation would be as follows:

$$P.L. = 24.4 - 0.403x$$

where P.L. = proportional limit load in kips

x = moisture content in percent.

It has been stated previously that the Canadian Standards Association gives modification factors for the use of green lumber in bolted joints (7). A comparison of these modification factors and those resulting from the use of the above equation is given in the following table.

TABLE 4Comparison of Modification Factors for Seasoning Conditions

<u>Moisture Content in Percent When Fabricated</u>	<u>Modification Factor</u>	
	<u>Canadian Standards Association</u>	<u>U. of A. Tests</u>
15	1.00	1.00
20	0.80	0.89
25	0.60	0.78
30	0.40	0.67

Compared to values obtained in this series of tests the modification factors given by the Canadian Standards Association appear to be conservative.

From Figure 15 it will be noted that the mean corrected value of the difference between the proportional limit load and the friction load for Group C lies very close to the regression line, on approximately the 5% confidence line. This means that there is a 95% probability that Group C belongs to the parent population of which Groups A and B are samples. Consequently it would seem that bolted joints that are seasoned after fabrication and have the nuts on the bolts retightened after seasoning are as strong as joints fabricated from seasoned lumber.

The point representing Group D on Figure 15 falls below the regression line, on approximately the 75% confidence line. This would indicate that there is a 75% probability that Group D does not belong to the parent population. Although this probability is not high enough to justify a conclusion that Group D does not definitely belong to the parent population it gives an indication

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Date	Particulars	Amount
Jan. 1	Balance forward	44
Jan. 1	From State	50
Jan. 1	From County	50
Jan. 1	From City	50

By order of the Board of Supervisors, J. H. Smith, Clerk.

Witness my hand and seal of office this 1st day of January, 1880.

J. H. Smith, Clerk.

Approved by the Board of Supervisors, this 1st day of January, 1880.

Attest: J. H. Smith, Clerk.

Witness my hand and seal of office this 1st day of January, 1880.

J. H. Smith, Clerk.

Approved by the Board of Supervisors, this 1st day of January, 1880.

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Attest: J. H. Smith, Clerk.

Witness my hand and seal of office this 1st day of January, 1880.

J. H. Smith, Clerk.

that this may possibly be the case. In other words, bolted joints that are seasoned after fabrication and which do not have the nuts on the bolts retightened after seasoning may not be as strong as joints fabricated from seasoned lumber. It should be noted on Figure 14 that all the points of Group D are below the regression line, none above.

Since the only difference between specimens of Group C and D was that the nuts on the bolts of Group C specimens were retightened before testing and those of Group D were not, any difference in strength between these two groups must be attributed to this factor. An attempt has been made to correct for that part of the load taken by friction between the wood pieces. Another contributing factor should also be considered. As a test progressed and slip took place between the wood pieces, some degree of bolt bending occurred. If the nuts on the bolts were tight the tension in the bolts would increase, thereby increasing the frictional force between the wood pieces. If the nuts were not tight no frictional forces would be present initially and bolt bending would not produce a frictional force until the bolt bending became great enough to take up the initial looseness. Since the nuts on the bolts of Group D were, prior to testing, loose enough to be turned with the fingers, it is likely that a frictional force caused by excessive bolt bending did not come into effect until considerable deformation had occurred, i.e. until after the proportional limit was passed. When the proportional limit was reached, this frictional force would be present in specimens of Groups A, B and C but would not be present

in specimens of Group D.

The fact that this effect was neglected in the correction made for friction may be the reason that the mean corrected value of the difference between the proportional limit load and the friction load for Group D is considerably below the regression line. Since the magnitude of this effect is unknown no definite statement can be made with regard to its relative importance. However, the results do not discount the possibility that bolted joints which are seasoned after fabrication and which do not have the nuts on the bolts retightened after seasoning are as strong as joints fabricated from seasoned lumber.

The mean corrected values of the difference between the ultimate load and the friction load exhibit no apparent relationship to moisture content. As a result, the mean ratios of the difference between the proportional limit load and the friction load to the difference between the ultimate load and the friction load for each group bear no relationship to each other. Other investigators have found that the ratio of proportional limit load to ultimate load is a constant for any one species, being about 0.67 for Douglas fir (9)(11). However, in these other investigations moisture content was not one of the variables. Since the proportional limit and the ultimate load are both strength properties a change in moisture content should have a similar effect on both of them.

Table 3 gives the mean ratios of the difference between the proportional limit load and the friction load to the difference

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between the ultimate load and the friction load for each group.

The value of this ratio for Group A was found to be 0.64 which is reasonably close to the value of 0.67 reported in other investigations.

The values of Groups B, C and D, however, were considerably lower.

The load-deflection curves (Figures 5 to 8) show that considerably more deflection occurred at ultimate load for Group B specimens than for the specimens of the other groups. Table 3 gives the mean deflection at ultimate load for Group B as approximately 0.58 inches whereas the mean deflection at ultimate load for all other groups was approximately 0.37 inches. This is probably due to the fact that green wood, although not as strong as seasoned wood, is more pliable and deforms more before failure (2).

CONCLUSIONS

The following conclusions apply to bolted joints in which the grain in the main member is parallel to the grain in the side plates.

1. The strength of a bolted joint is reduced by an increase in moisture content. Modification factors obtained in this investigation, for joints fabricated from unseasoned lumber are listed in Table 5.

TABLE 5

Modification Factors for Seasoning and Service Conditions Obtained In This Investigation

<u>Moisture Content in Percent When Fabricated</u>	<u>Condition of Timber in Use</u>	<u>Modification Factor</u>
15	dry	1.00
20	dry	0.89
25	dry	0.78
30	dry	0.67

2. Bolted joints that are seasoned after fabrication and which have the nuts on the bolts retightened after seasoning are as strong as joints fabricated from seasoned lumber.
3. From the available data it is uncertain whether bolted joints that are seasoned after fabrication and which do not have the nuts on the bolts retightened after seasoning are as strong as joints fabricated from seasoned lumber.
4. No definite relationship between the ultimate strength and the moisture content of bolted joints was indicated by this investigation.
5. The deflection at ultimate load for bolted joints in material

TABLE

The following table shows the results of the experiments conducted on the effect of the temperature of the water on the rate of the reaction between the potassium permanganate and the oxalic acid. The results are given in the following table, the first column being the temperature of the water, the second column the time taken for the reaction to take place, and the third column the volume of the gas evolved.

Temperature of water (°C)	Time taken for reaction (min)	Volume of gas evolved (c.c.)
10	10	10
20	10	10
30	10	10
40	10	10

The results of the experiments show that the rate of the reaction between the potassium permanganate and the oxalic acid is not affected by the temperature of the water. This is in agreement with the results of the experiments conducted on the effect of the temperature of the water on the rate of the reaction between the potassium permanganate and the oxalic acid. The results are given in the following table, the first column being the temperature of the water, the second column the time taken for the reaction to take place, and the third column the volume of the gas evolved.

with a high moisture content is considerably greater than that for joints in seasoned material.

BIBLIOGRAPHY

- (1) Reece, P. O.
1949. The Design of Timber Structures.
E. and F. N. Spon Limited, London, England.
- (2) Timber Engineering Company.
1956. Timber Design and Construction Handbook.
F. W. Dodge Corporation, New York, New York.
- (3) Trayer, G. W.
1932. The Bearing Strength of Wood Under Bolts.
Forest Products Laboratory, Madison, Wisconsin.
- (4) Hansen, H. J.
1948. Modern Timber Design.
John Wiley and Sons, Inc., New York, New York.
- (5) National Research Council, Canada.
1953. National Building Code of Canada.
Section 4.3. Wood.
- (6) National Lumber Manufacturers Association.
1944. National Design Specification for Stress-Grade Lumber and its Fastenings. (Revised 1952).
National Lumber Manufacturers Association, Washington, D.C.
- (7) Canadian Standards Association.
1959. Code of Recommended Practice for Engineering Design in Timber. 086 - 1959.
Canadian Standards Association, Ottawa, Ontario.
- (8) British Columbia Lumber Manufacturers Association.
1959. Standard Grading and Dressing Rules for Lumber.

British Columbia Lumber Manufacturers Associations, Vancouver, B.C.

(9) Forest Products Laboratory.

1946. Bolt Bearing Strength of Wood and Modified Wood.

U.S. Forest Products Laboratory, Madison, Wisconsin.

Report No. 1523 - C.

(10) Forest Products Laboratory.

1945. Bolt Bearing Strength of Wood and Modified Wood.

U.S. Forest Products Laboratory, Madison, Wisconsin.

Report No. 1523 - A.

(11) Forest Products Laboratory.

1946. Bolt Bearing Strength of Wood and Modified Wood.

U.S. Forest Products Laboratory, Madison, Wisconsin.

Report No. 1523 - D.

(12) Kenney, J.F. and Keeping, E.S.

1954. Mathematics of Statistics, Part 1.

D. Van Nostrand Company, Inc., Princeton, New Jersey.

(13) Kenney, J. F. and Keeping, E.S.

1951. Mathematics of Statistics, Part 2.

D. Van Nostrand Company, Inc., Princeton, New Jersey.

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APPENDIX A

Statistical Analysis

If a straight line is fitted by least squares to the dots of the scatter diagram (Figure 14) in such a way as to minimize the sum of the squares of the distances parallel to the y axis from the dots to the line, the regression line of y on x is obtained (12)(13). This line has the equation $y = a + bx$.

$$b = \frac{N\sum xy - \sum x \sum y}{N\sum x^2 - (\sum x)^2}$$

$$a = \frac{(\sum y - b\sum x)}{N}$$

where y = an individual measurement, in this case the corrected value of the difference between the proportional limit load and the friction load, expressed in kips.

x = an individual measurement, in this case the moisture content in percent.

N = number of pairs of individual measurements. In this case

Groups A and B are combined and $N = 30$.

$$\bar{x} = \frac{\sum x}{N} = \text{average measurement or mean.}$$

$$\bar{y} = \frac{\sum y}{N} = \text{average measurement or mean.}$$

$$S_x = \sqrt{\sum (x - \bar{x})^2 / N} = \text{standard deviation of } x.$$

$$S_y = \sqrt{\sum (y - \bar{y})^2 / N} = \text{standard deviation of } y.$$

$$S_{xy} = \sum (x - \bar{x})(y - \bar{y}) / N = \text{covariance of } x \text{ and } y.$$

Considering Groups A and B and using values from Table 6 the following can be obtained:

$$b = -0.403$$

$$a = 24.4$$

TABLE 6

STATISTICAL ANALYSIS

(1) Joint No.	(2) x	(3) y	(4) x^2	(5) y^2	(6) xy	(7) $y-\bar{y}$	(8) $(y-\bar{y})^2$	(9) $x-\bar{x}$	(10) $(x-\bar{x})^2$	(11) $(y-\bar{y})(x-\bar{x})$
A-1	10.8	17.2	117	296	186	- .3	.09	- 6.3	39.69	+ 1.89
A-2	12.3	22.1	151	488	272	+ 4.6	21.16	- 4.8	23.04	- 22.08
A-3	11.3	20.9	128	437	236	+ 3.4	11.56	- 5.8	33.64	- 19.72
A-4	10.7	19.7	114	388	211	+ 2.2	4.84	- 6.4	40.96	- 14.08
A-5	11.1	16.6	123	276	184	- .9	.81	- 6.0	36.00	+ 5.40
A-6	13.8	22.1	190	488	305	+ 4.6	21.16	- 3.3	10.89	- 15.18
A-7	11.8	20.5	139	420	242	+ 3.0	9.00	- 5.3	28.09	- 15.90
A-8	11.9	23.0	141	528	274	+ 5.5	30.25	- 5.2	27.04	- 28.60
A-9	12.4	20.1	154	404	249	+ 2.6	6.76	- 4.7	22.09	- 12.22
A-10	12.9	21.7	166	471	280	+ 4.2	17.64	- 4.2	17.64	- 17.64
A-11	12.8	16.9	164	286	216	- .6	.36	- 4.3	18.49	+ 2.58
A-12	11.8	19.1	139	364	225	+ 1.6	2.56	- 5.3	28.09	- 8.48
A-13	12.3	19.4	151	376	239	+ 1.9	3.61	- 4.8	23.04	- 9.12
A-14	11.0	21.9	121	479	241	+ 4.4	19.36	- 6.1	37.21	- 26.84
A-15	11.5	15.4	132	237	177	- 2.1	4.41	- 5.6	31.36	+ 11.76
B-1	23.7	15.8	561	249	374	- 1.7	2.89	+ 6.6	43.56	- 11.22
B-2	24.9	14.7	620	216	366	- 2.8	7.84	+ 7.8	60.84	- 21.84
B-3	25.0	15.5	625	240	388	- 2.0	4.00	+ 7.9	62.41	- 15.80
B-4	22.4	18.3	502	335	410	+ .8	.64	+ 5.3	28.09	+ 4.24
B-5	22.5	13.2	506	174	297	- 4.3	18.49	+ 5.4	29.16	- 23.22

2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
| | | | | | | | | | | | | | | | | |

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
| | | | | | | | | | | | | | | | | |

61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
| | | | | | | | | | | | | | | | | |

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120

121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140

141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160

TABLE 6 (CONT'D.)

STATISTICAL ANALYSIS

(1) Joint No.	(2) x	(3) y	(4) x^2	(5) y^2	(6) xy	(7) $y-\bar{y}$	(8) $(y-\bar{y})^2$	(9) $x-\bar{x}$	(10) $(x-\bar{x})^2$	(11) $(y-\bar{y})(x-\bar{x})$
B-6	19.8	14.0	392	196	277	- 3.5	12.25	+ 2.7	7.29	- 9.45
B-7	19.5	12.8	380	164	250	- 4.7	22.09	+ 2.4	5.76	- 11.28
B-8	22.5	17.3	506	299	389	- .2	.04	+ 5.4	29.16	- 1.08
B-9	21.1	17.0	445	289	359	- .5	.25	+ 4.0	16.00	- 2.00
B-10	20.3	14.0	412	196	284	- 3.5	12.25	+ 3.2	10.24	- 11.20
B-11	22.8	14.7	520	216	335	- 2.8	7.84	+ 5.7	32.49	- 15.96
B-12	22.7	15.7	515	246	356	- 1.8	3.24	+ 5.6	31.36	- 10.08
B-13	21.9	14.2	479	202	311	- 3.3	10.89	+ 4.8	23.04	- 15.84
B-14	21.0	18.0	441	324	378	+ .5	.25	+ 3.9	15.21	+ 1.95
B-15	24.6	12.2	605	149	300	- 5.3	28.09	+ 7.5	56.25	- 39.75

$$\begin{aligned} \bar{x} &= 17.1 & \Sigma y^2 &= 9,433 \\ \bar{y} &= 17.5 & \Sigma xy &= 8,611 \\ \Sigma x &= 513.1 & \Sigma (y-\bar{y})^2 &= 284.62 \\ \Sigma y &= 524.0 & \Sigma (x-\bar{x})^2 &= 868.13 \\ \Sigma x^2 &= 9,639 & \Sigma (y-\bar{y})(x-\bar{x}) &= -350.76 \end{aligned}$$

$$\bar{x} = 17.1$$

$$\bar{y} = 17.5$$

$$S_y = 3.08$$

$$S_x = 5.38$$

$$S_{xy} = -11.69$$

Thus, the equation of the regression line shown on Figures 14 and 15 is $y = 24.4 - .403x$. Using the Student t-test to determine the significance of the slope of the regression line, the following formula is used:

$$t = r \left(\frac{N - 2}{1 - r^2} \right)^{1/2}$$

$$\text{where } r = \frac{N\sum xy - \sum x \sum y}{\left[N\sum x^2 - (\sum x)^2 \right]^{1/2} \left[N\sum y^2 - (\sum y)^2 \right]^{1/2}}$$

Again, using values from Table 6 and $N = 30$, it is found that $r = 0.708$. The corresponding value of t is found to be 5.30. If the value of t computed above (5.30) is greater than the value t_{α} (from tables) corresponding to an assigned significance level and the given $N-2$ degrees of freedom, it can be said that the observed slope of the regression line is significant. From tables, the value of t_{α} for 95% probability and for $N-2 = 28$ degrees of freedom is 2.048. Since 5.30 is considerably greater than 2.048 it can be said that there is a greater than 95% chance that the slope of the regression line is significant and that an increase in moisture content has the effect of reducing the proportional limit load for a joint.

The confidence limits for the regression line have been

plotted on Figures 14 and 15. These confidence limits give the probability of a joint belonging to the parent population of which Groups A and B are samples. For example, if a certain joint of the same type as those tested in this investigation were tested and the results happened to plot on the 10% confidence limit of Figure 14 or 15, it could be said that there is a 90% probability that this joint belongs to the parent population and that it did not fall on the regression line because of a chance error. It could also be said that there is a 10% probability that this joint does not belong to the parent population and that it did not fall on the regression line because of some inherent difference between it and specimens of the parent population.

These confidence limits were plotted from the following formula:

$$y = a + bx \pm t_{\alpha} \hat{\sigma}_{ey} \left[1 + N^{-1} + \frac{(x - \bar{x})^2}{NSx^2} \right]^{\frac{1}{2}}$$

$$\text{where } \hat{\sigma}_{ey}^2 = NSy^2 \frac{(1 - r^2)}{N-2}$$

The values of y from the above equation are tabulated in Table 7 for various values of t_{α} and x.

TABLE 7

Solutions of Confidence Limit Equation

x	9.1	13.1	17.1	21.1	25.1
95% Confidence Limits	15.9	14.4	12.8	11.2	9.5
$t_{0.05} = 2.048$	25.5	23.8	22.2	20.6	19.1
80% Confidence Limits	17.6	16.1	14.5	12.9	11.2
$t_{0.20} = 1.313$	23.8	22.1	20.5	18.9	17.4
70% Confidence Limits	18.2	16.7	15.1	13.5	11.8
$t_{0.30} = 1.056$	23.2	21.5	19.9	18.3	16.8
10% Confidence Limits	20.4	18.8	17.2	15.6	14.0
$t_{0.90} = 0.127$	21.0	19.4	17.8	16.2	14.6

APPENDIX B

Tension Tests on Bolts

Six bolts of the same type used in the joint specimens of this investigation were tested in tension. They were tested in a 200,000 pound universal testing machine equipped with a bolt testing apparatus as shown in Figure 16. A Microformer Stress-Strain Recorder operating on a two inch gauge length was used to record the load-strain curves of Figure 17. In all six tests the ultimate failure occurred in the threaded portion of the bolt, which was outside the gauge points. The gross diameter of the bolts was 0.750 inch giving a gross area of 0.442 square inches and the diameter at the base of the thread was 0.620 inch giving a net area of 0.302 square inches. Table 8 summarizes the results of the tests.

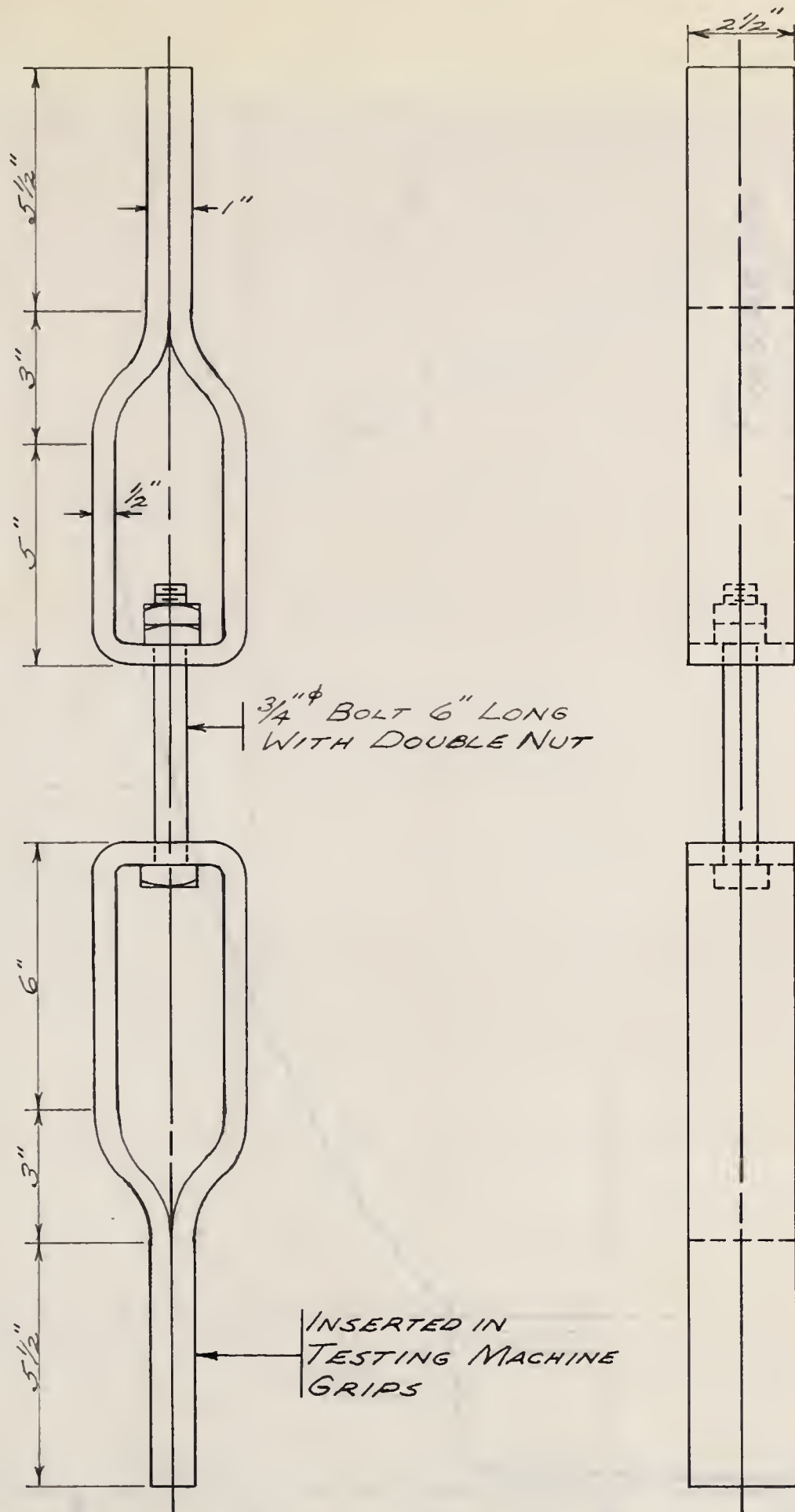
TABLE 8

Results of Tension Tests of Bolts

<u>Bolt No.</u>	<u>Yield Load Lbs.</u>	<u>Ultimate Load Lbs.</u>	<u>Yield Stress P.S.I.</u>	<u>Ultimate Stress P.S.I.</u>
1	14,300	23,750	32,400	78,600
2	15,100	25,700	34,200	85,100
3	15,300	24,850	34,600	82,300
4	15,450	26,600	35,000	88,000
5	14,500	25,350	32,800	83,900
6	13,900	22,100	31,500	73,200
Mean	14,758	24,725	33,417	81,850

Note: Rate of Loading = 5,000 #/Min.

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 84



BOLT TESTING APPARATUS
FIGURE 16
SCALE $\frac{1}{4}'' = 1''$

BOLT TESTING APPARATUS
FIGURE 12
SCALE 1/4" = 1"

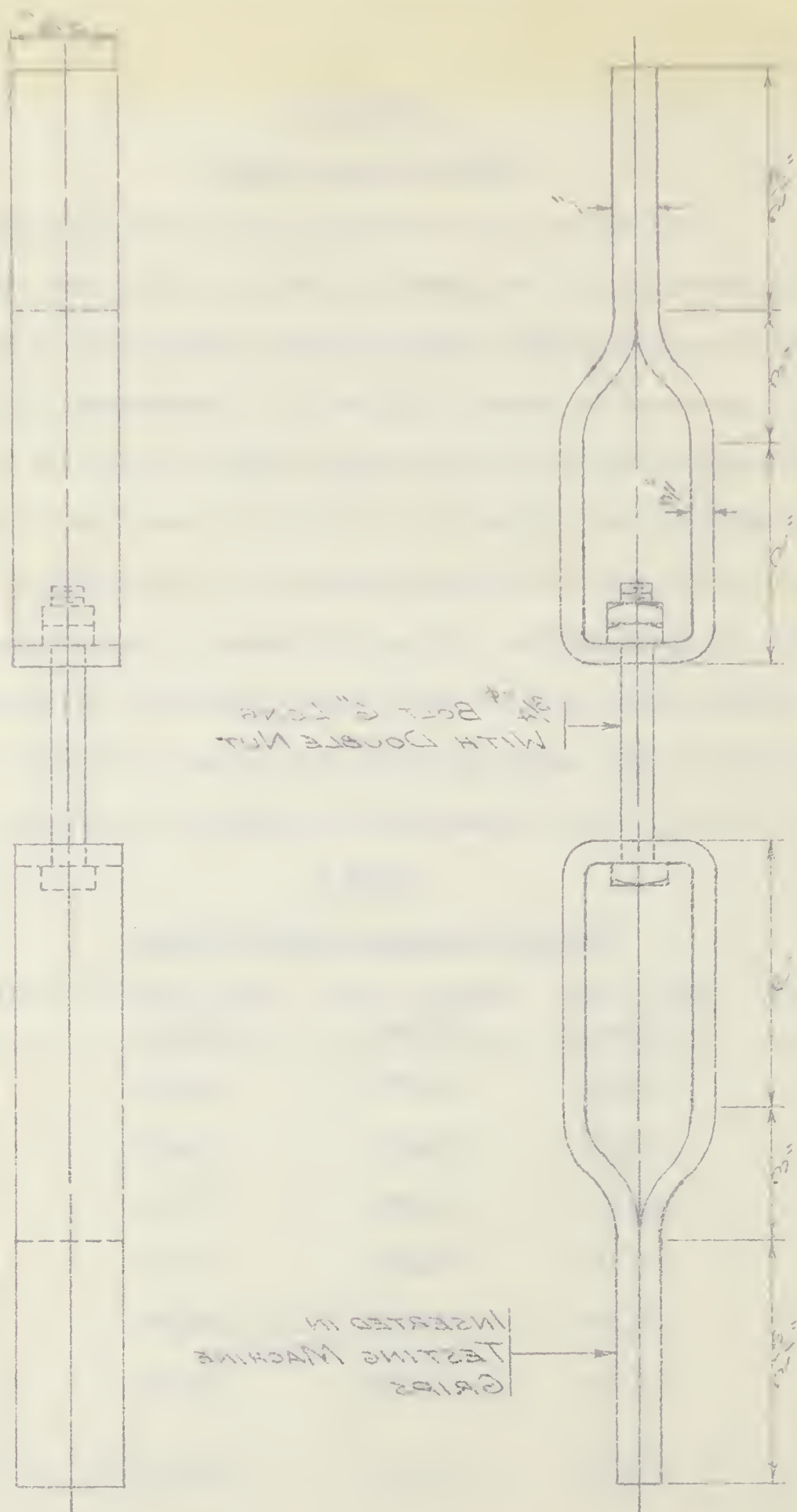
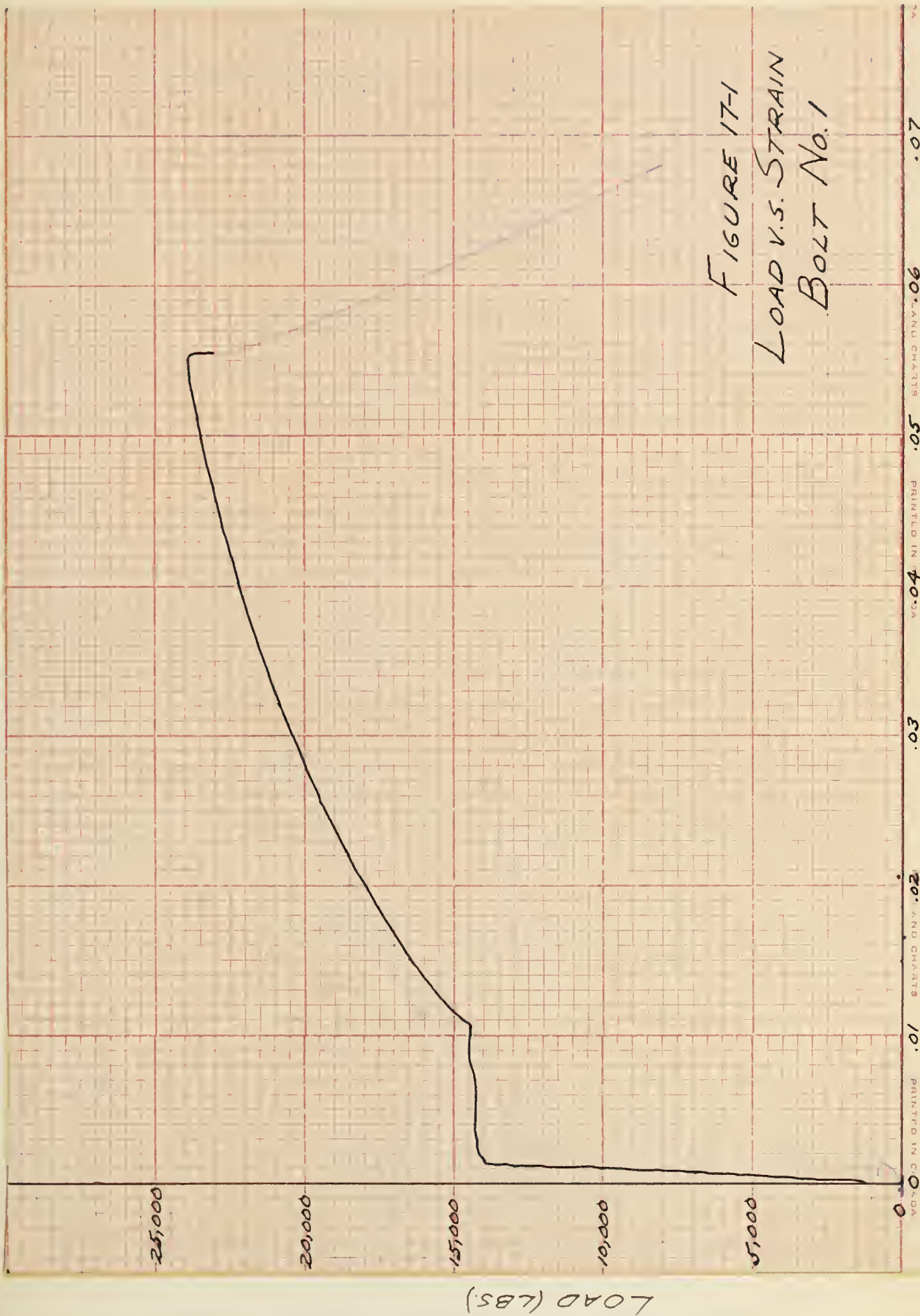
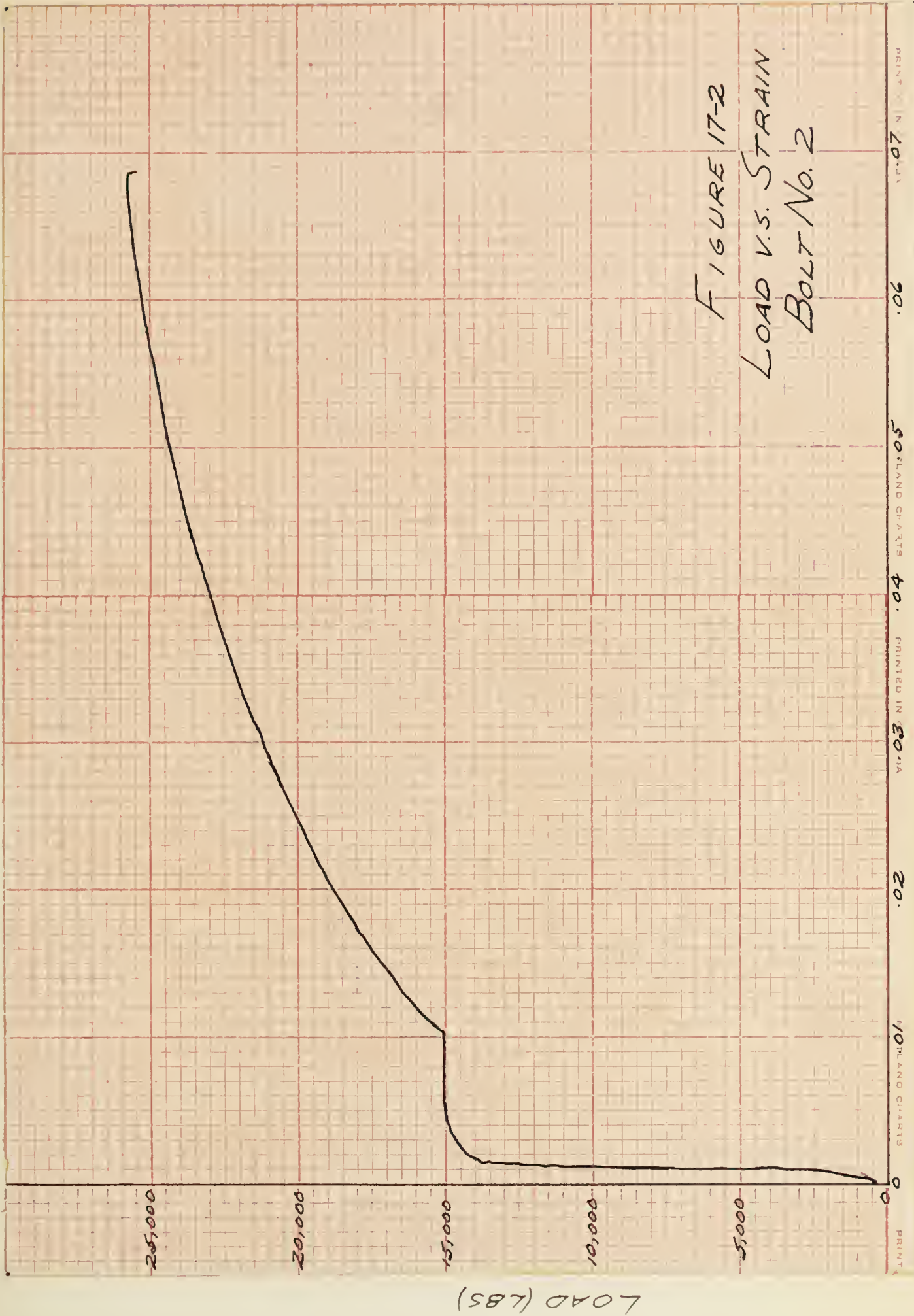


FIGURE 17-1
LOAD V.S. STRAIN
BOLT No. 1



STRAIN (in./in.)

FIGURE 17-2
LOAD V.S. STRAIN
BOLT No. 2



STRAIN (IN./IN.)



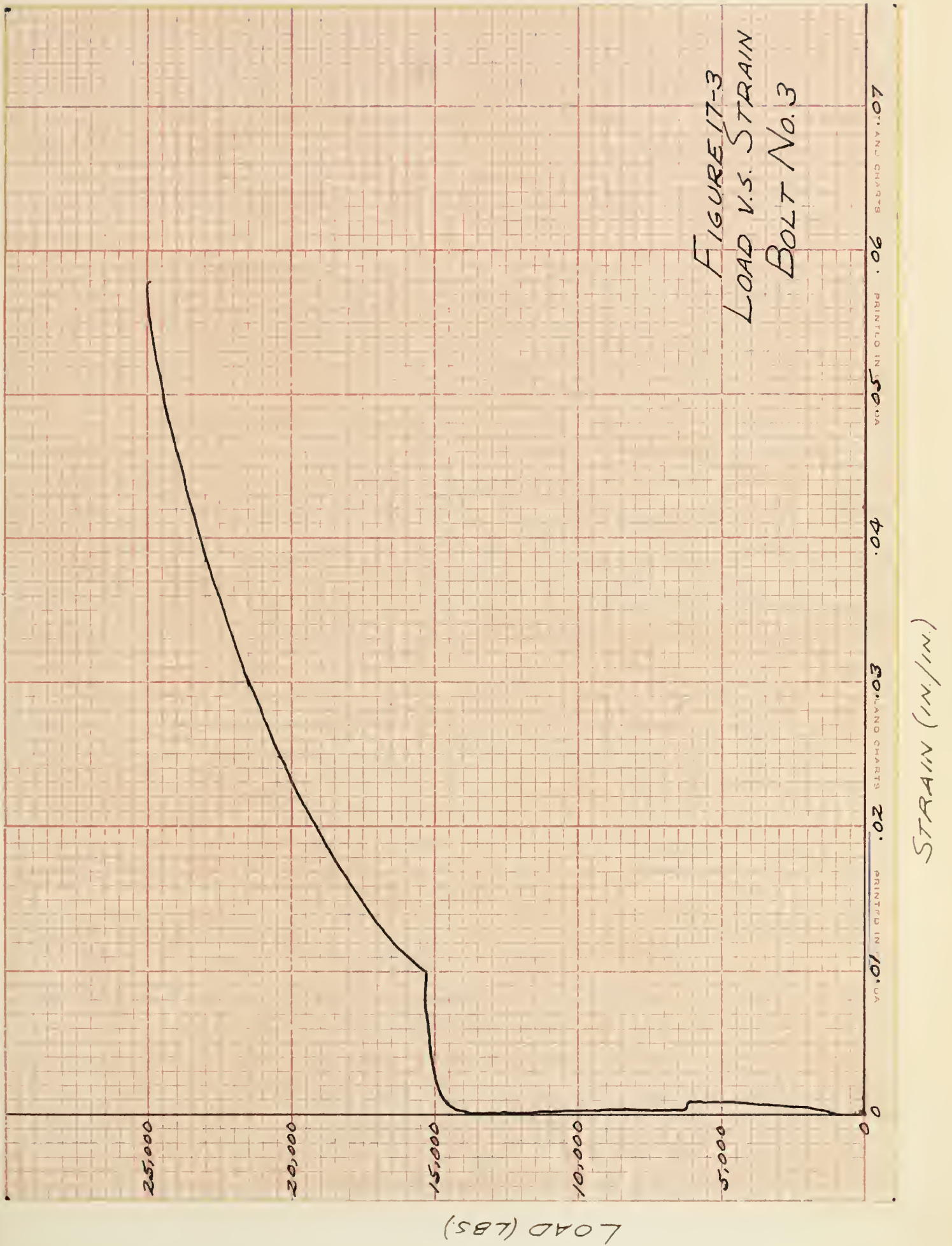
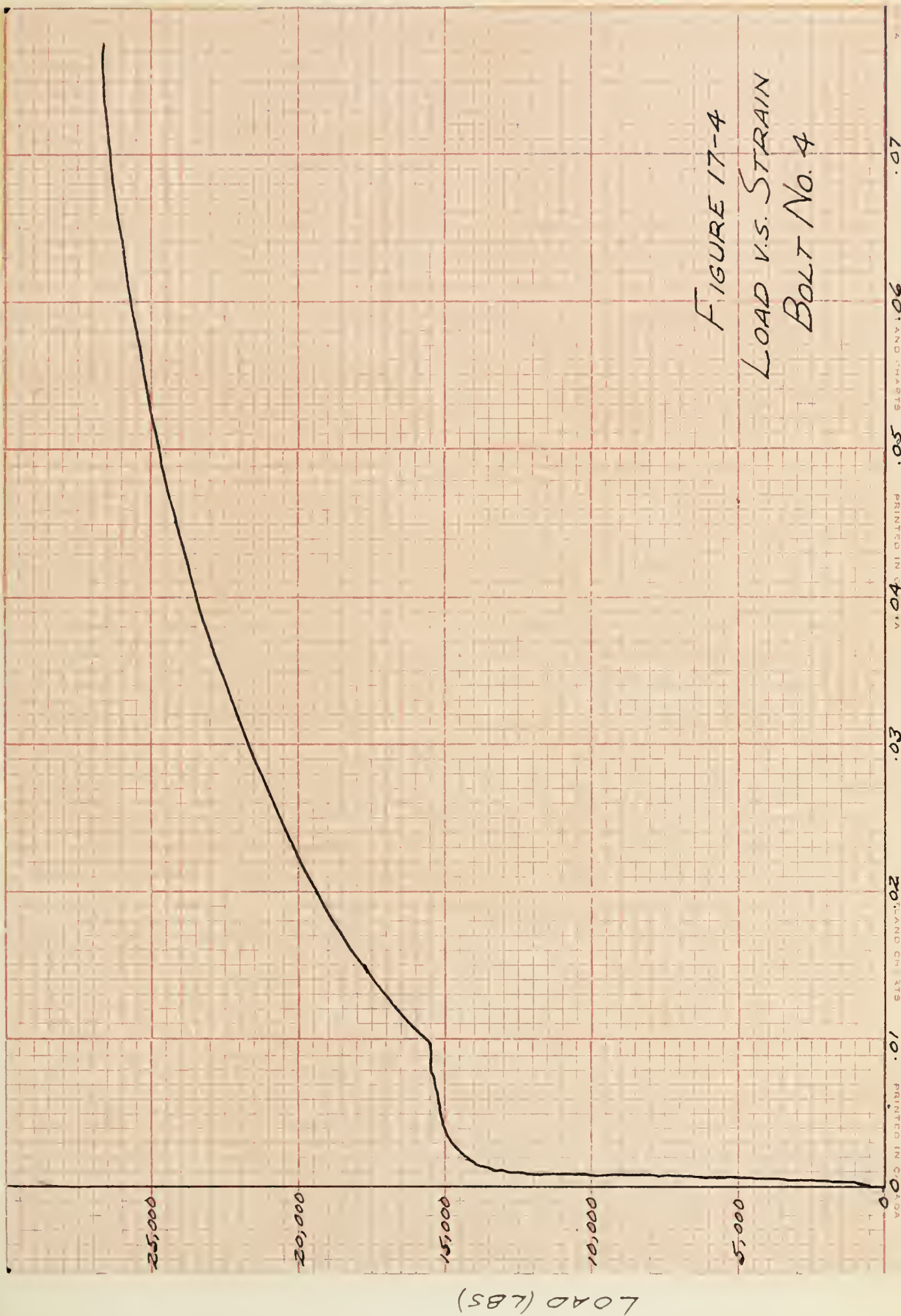


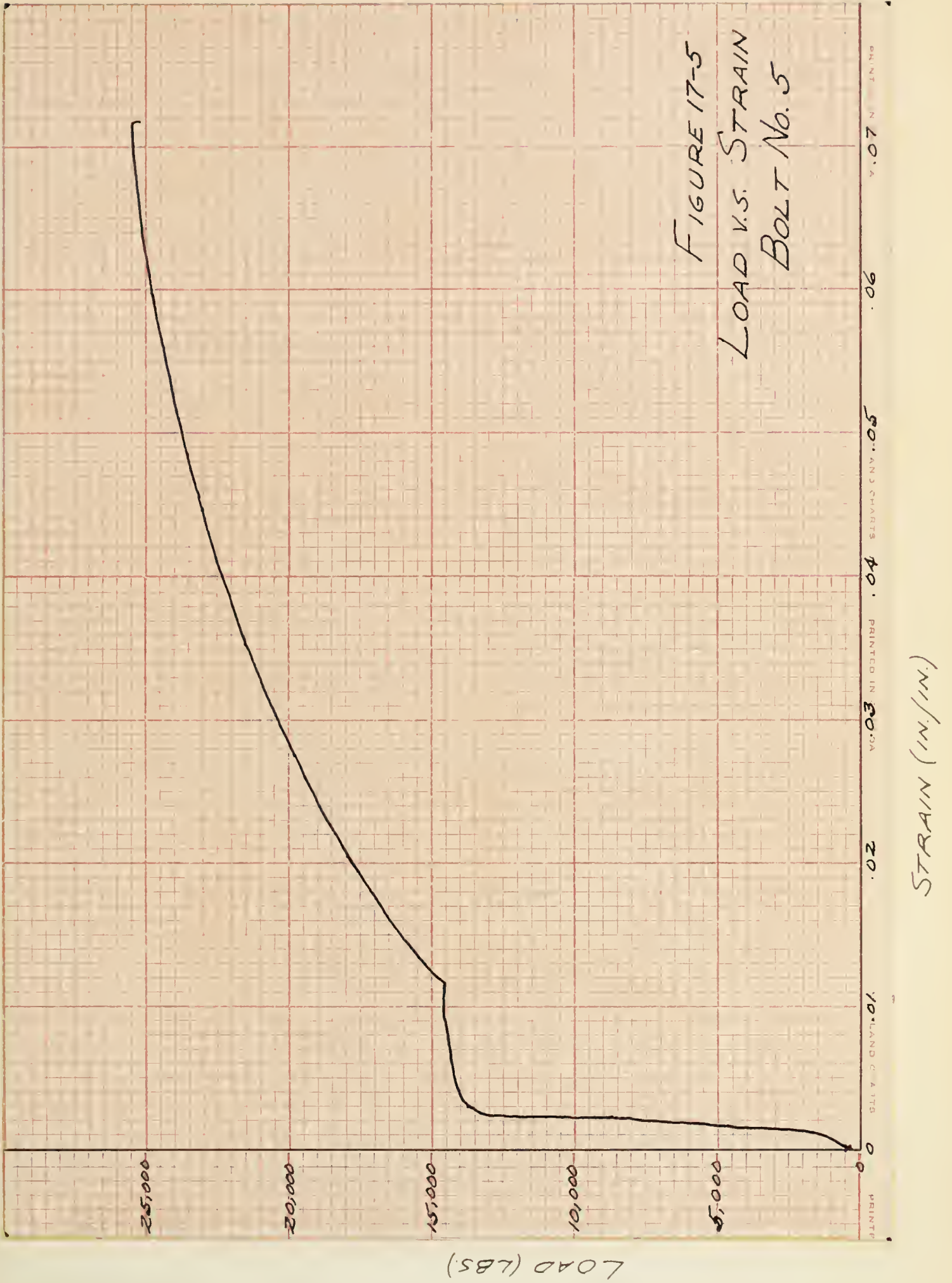


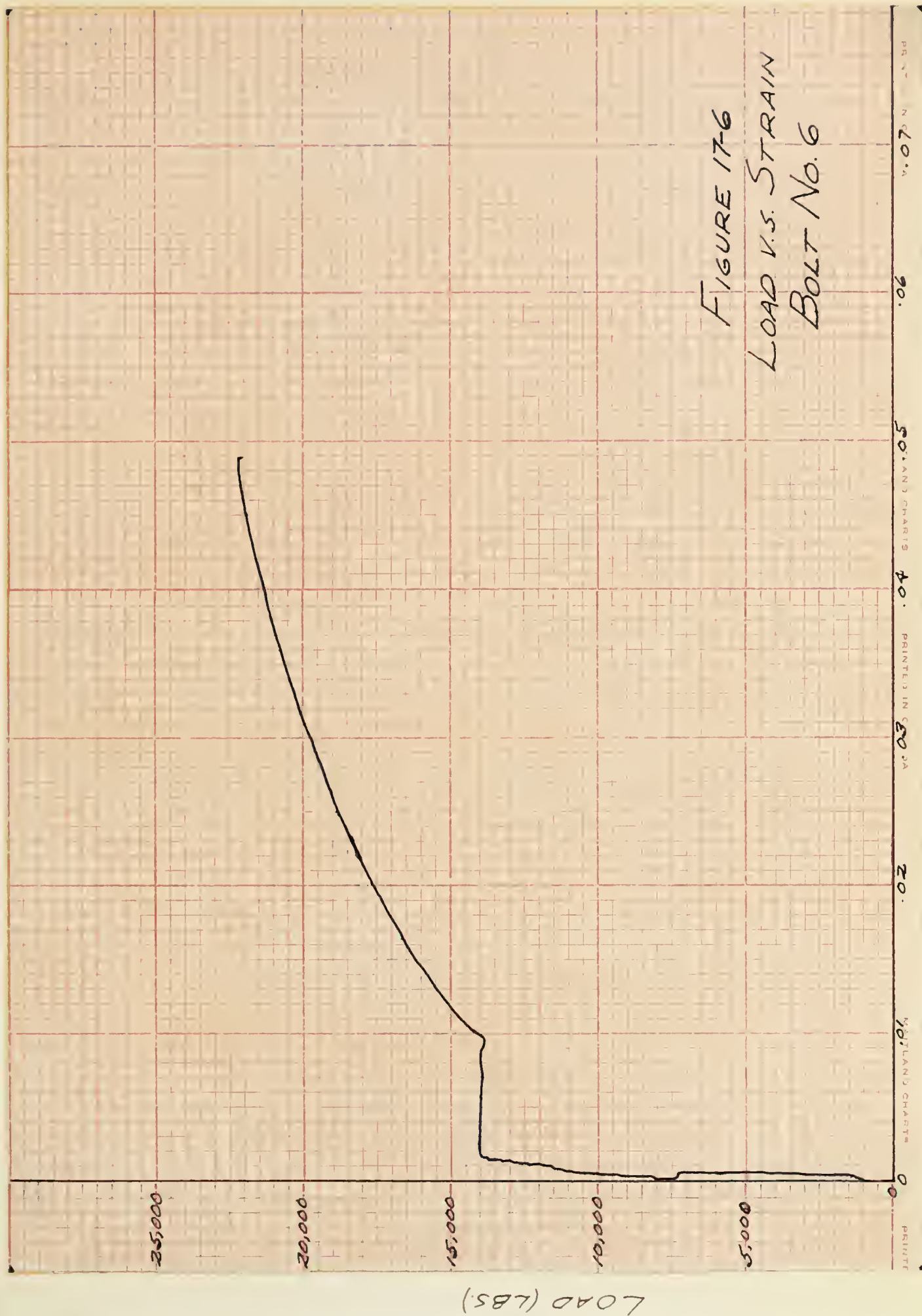
FIGURE 17-4
LOAD V.S. STRAIN
BOLT No. 4



STRAIN (IN./IN.)

LOAD (LBS)





STRAIN (IN./IN.)

APPENDIX C

Compression Tests on Small Douglas Fir Specimens

Three specimens cut from lumber left over from the manufacture of the bolted joints were tested in compression parallel to the grain. The specimens were 2 inches by 2 inches in cross-section and 8 inches long. The ends of each specimen were capped with a mixture of sulfur and fire clay to ensure parallelism. Before testing, each specimen was fitted with two Mercer dials located on opposite faces of the specimen. These dials, which were graduated to 0.0001 inch, measured deformation over a gauge length of four inches. On each face on which a dial was located an SR-4 strain gauge was also mounted on the specimen. These strain gauges were read to 0.00001 inch.

The specimens were loaded at a rate of 1,000 pounds per minute. At each increment of load the loading was held while strain readings were taken. On completion of the test a small sample approximately 2 inches by 2 inches by 2 inches was cut from the compression specimen for the determination of moisture content and specific gravity.

All three specimens failed by vertical splitting, the mean ultimate load being 27,700 pounds and the mean ultimate stress being 6,900 pounds per square inch. Test data are given in Tables 9 and 10. Stress-strain curves for all three specimens are plotted in Figure 19.

TABLE 9 - 1

Stress-Strain Data for Compression Test on Douglas Fir

Specimen No. 1 Date: Feb. 26, 1960 Rate of Loading: 1,000 Lb./Min.
 Moisture Content: 5.8% Specific Gravity: 0.514 Time: 3:58 p.m. End: 4:23 p.m.

| Load
Lbs. | Stress
P.S.I. | Dial No. 1
Inches | Dial No. 2
Inches | Average
Deflection
Inches | Average
Strain
In./In. | Strain
Gauge No. 1
In./In. | Strain
Gauge No. 2
In./In. | Average
Strain
In./In. |
|--------------|------------------|----------------------|----------------------|---------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------------|
| 0 | 0 | .2000 | .0200 | 0 | 0 | .01109 | .01110 | 0 |
| 3 000 | 750 | .1976 | .0247 | .00115 | .000288 | .01114 | .01033 | .000360 |
| 6 000 | 1 500 | .1970 | .0283 | .00265 | .000662 | .01100 | .00978 | .000705 |
| 9 000 | 2 250 | .1971 | .0309 | .00400 | .001000 | .01072 | .00940 | .001035 |
| 12 000 | 3 000 | .1983 | .0324 | .00535 | .001338 | .01036 | .00908 | .001375 |
| 15 000 | 3 750 | .2002 | .0336 | .00690 | .001725 | .00992 | .00881 | .001730 |
| 18 000 | 4 500 | .2024 | .0347 | .00855 | .002138 | .00946 | .00855 | .002090 |
| 21 000 | 5 250 | .2046 | .0349 | .00975 | .002438 | .00893 | .00836 | .002450 |
| 24 000 | 6 000 | .2091 | .0337 | .01140 | .002850 | .00813 | .00822 | .002920 |
| 26 500 | 6 625 | | | | | | | |

U L T I M A T E

FAILURE: Vertical Splitting

TABLE 9 - 2

Stress-Strain Data for Compression Test on Douglas Fir

| | | | | | | | | |
|------------------------|------------------|-------------------------|----------------------|---------------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------------|
| Specimen No. 2 | | Date: Feb. 29, 1960 | | Rate of Loading: 1,000 Lb./Min. | | | | |
| Moisture Content: 5.6% | | Specific Gravity: 0.527 | | Time: Begin: 4:35 p.m. End: 5:05 p.m. | | | | |
| Load
Lbs. | Stress
P.S.I. | Dial No. 1
Inches | Dial No. 2
Inches | Average
Deflection
Inches | Average
Strain
In./In. | Strain
Gauge No. 1
In./In. | Strain
Gauge No. 2
In./In. | Average
Strain
In./In. |
| 0 | 0 | .2400 | .0100 | 0 | 0 | .01045 | .01071 | 0 |
| 2 000 | 500 | .2389 | .0132 | .00155 | .000388 | .01046 | .01026 | .000220 |
| 4 000 | 1 000 | .2391 | .0146 | .00185 | .000462 | .01028 | .01002 | .000430 |
| 6 000 | 1 500 | .2400 | .0155 | .00275 | .000688 | .01006 | .00977 | .000665 |
| 8 000 | 2 000 | .2409 | .0163 | .00360 | .000900 | .00984 | .00956 | .000880 |
| 10 000 | 2 500 | .2420 | .0170 | .00450 | .001125 | .00963 | .00933 | .001100 |
| 12 000 | 3 000 | .2430 | .0178 | .00540 | .001350 | .00940 | .00912 | .001320 |
| 14 000 | 3 500 | .2440 | .0186 | .00630 | .001575 | .00918 | .00890 | .001540 |
| 16 000 | 4 000 | .2451 | .0195 | .00730 | .001825 | .00894 | .00871 | .001755 |
| 18 000 | 4 500 | .2463 | .0200 | .00815 | .002038 | .00869 | .00852 | .001975 |
| 20 000 | 5 000 | .2480 | .0204 | .00920 | .002300 | .00841 | .00835 | .002200 |
| 22 000 | 5 500 | .2490 | .0210 | .01000 | .002500 | .00816 | .00816 | .002420 |

TABLE 9 - 2 (CONT'D.)

Stress-Strain Data for Compression Test on Douglas Fir

| Load
Lbs. | Stress
P.S.I. | Dial No. 1
Inches | Dial No. 2
Inches | Average
Deflection
Inches | Average
Strain
In./In. | Strain
Gauge No. 1
In./In. | Strain
Gauge No. 2
In./In. | Average
Strain
In./In. |
|--------------|------------------|----------------------|----------------------|---------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------------|
| 24 000 | 6 000 | .2503 | .0221 | .01120 | .002800 | .00798 | .00790 | .002640 |
| 26 000 | 6 500 | .2518 | .0231 | .01245 | .003112 | .00774 | .00766 | .002880 |
| 27 750 | 6 938 | U L T I M A T E | | | | | | |

FAILURE: Vertical Splitting.

TABLE 9 - 3

Stress-Strain Data for Compression Test on Douglas Fir

| | | | | | | | | |
|-------------------|------------------|----------------------|----------------------|---------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------------|
| Specimen No. | 3 | Date: | March 2, 1960 | Rate of Loading: 1,000 Lb./Min. | | | | |
| Moisture Content: | 5.6% | Specific Gravity: | 0.529 | Time: | Begin: 4:43 p.m. | End: 5:13 p.m. | | |
| Load
Lbs. | Stress
P.S.I. | Dial No. 1
Inches | Dial No. 2
Inches | Average
Deflection
Inches | Average
Strain
In./In. | Strain
Gauge No. 1
In./In. | Strain
Gauge No. 2
In./In. | Average
Strain
In./In. |
| 0 | 0 | .1500 | .0800 | 0 | 0 | .01093 | .01128 | 0 |
| 2 000 | 500 | .1520 | .0802 | .00110 | .000275 | .01064 | .01113 | .000220 |
| 4 000 | 1 000 | .1529 | .0808 | .00185 | .000462 | .01040 | .01091 | .000450 |
| 6 000 | 1 500 | .1540 | .0818 | .00290 | .000725 | .01017 | .01067 | .000685 |
| 8 000 | 2 000 | .1549 | .0826 | .00375 | .000938 | .00996 | .01043 | .000910 |
| 10 000 | 2 500 | .1557 | .0836 | .00465 | .001162 | .00976 | .01019 | .001130 |
| 12 000 | 3 000 | .1566 | .0845 | .00555 | .001388 | .00955 | .00996 | .001350 |
| 14 000 | 3 500 | .1575 | .0854 | .00645 | .001612 | .00935 | .00971 | .001575 |
| 16 000 | 4 000 | .1583 | .0863 | .00730 | .001825 | .00915 | .00947 | .001795 |
| 18 000 | 4 500 | .1592 | .0874 | .00830 | .002075 | .00895 | .00921 | .002025 |
| 20 000 | 5 000 | .1600 | .0886 | .00930 | .002325 | .00874 | .00896 | .002255 |

TABLE 9 - 3 (CONT'D.)

Stress-Strain Data for Compression Test on Douglas Fir

| Load
Lbs. | Stress
P.S.I. | Dial No. 1
Inches | Dial No. 2
Inches | Average
Deflection
Inches | Average
Strain
In./In. | Strain
Gauge No. 1
In./In. | Strain
Gauge No. 2
In./In. | Average
Strain
In./In. |
|--------------|------------------|----------------------|----------------------|---------------------------------|------------------------------|----------------------------------|----------------------------------|------------------------------|
| 22 000 | 5 500 | .1608 | .0895 | .01015 | .002538 | .00854 | .00872 | .002475 |
| 24 000 | 6 000 | .1617 | .0906 | .01115 | .002788 | .00834 | .00847 | .002700 |
| 26 000 | 6 500 | .1623 | .0924 | .01235 | .003088 | .00813 | .00820 | .002940 |
| 28 000 | 7 000 | .1625 | .0944 | .01345 | .003362 | .00800 | .00785 | .003180 |
| 28 950 | 7 238 | U L T I M A T E | | | | | | |

FAILURE: Vertical Splitting.

TABLE 10

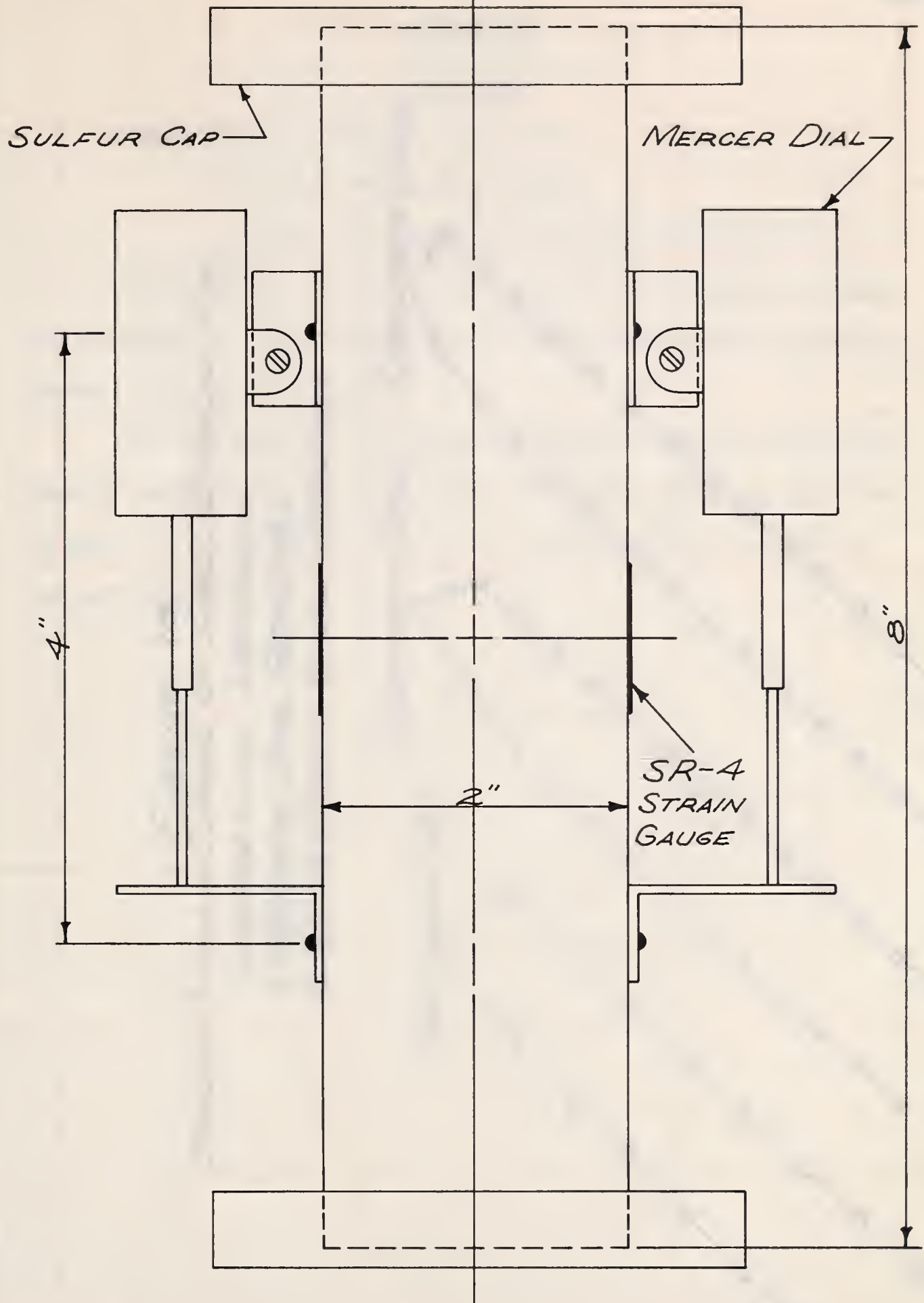
MOISTURE CONTENT AND SPECIFIC GRAVITY
FOR COMPRESSION TESTS ON DOUGLAS FIR

| <u>MOISTURE CONTENT</u> | | | | |
|-------------------------|---------|-------|-------|-------|
| Specimen No. | | 1 | 2 | 3 |
| Wet Weight | | 57.42 | 56.48 | 54.56 |
| Dry Weight | | 54.27 | 53.47 | 51.68 |
| Weight of Water | | 3.15 | 3.01 | 2.88 |
| Moisture Content (%) | | 5.8 | 5.6 | 5.6 |
| <u>SPECIFIC GRAVITY</u> | | | | |
| Dry Weight + Paraffin | | 56.59 | 55.52 | 54.54 |
| Dry Weight | | 54.27 | 53.47 | 51.68 |
| Weight of Paraffin | | 2.32 | 2.05 | 2.86 |
| Volume | Trial | 1 | 108 | 104 |
| of | Number | 2 | 109 | 104 |
| Sample | | 3 | 108 | 104 |
| + | Sum | | 325 | |
| Paraffin | Average | | 108.3 | 104.0 |
| *Volume of Paraffin | | | 2.6 | 2.3 |
| Volume of Sample | | | 105.7 | 101.7 |
| Specific Gravity | | | 0.514 | 0.527 |

*Specific Gravity of Paraffin 0.893

All weights measured in grams.

All volumes measured in centimeters³.



TEST SETUP FOR SMALL DOUGLAS
FIR COMPRESSION SPECIMENS
FIGURE 1B
FULL SCALE

TEST SETUP FOR SMALL BOLLAS
 FIA COMPRESSION SPECIMENS
 FIGURE 18
 FULL SCALE

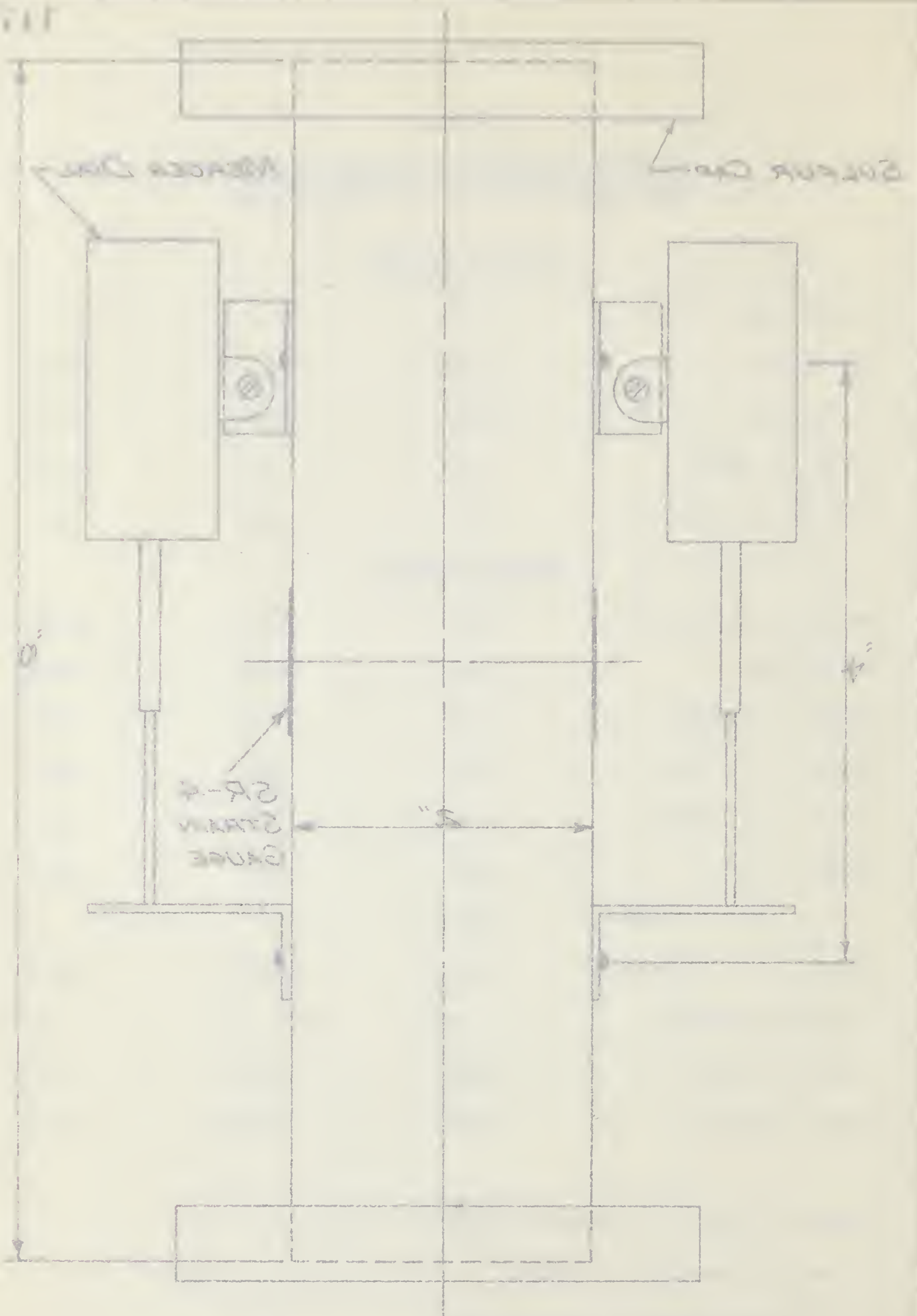
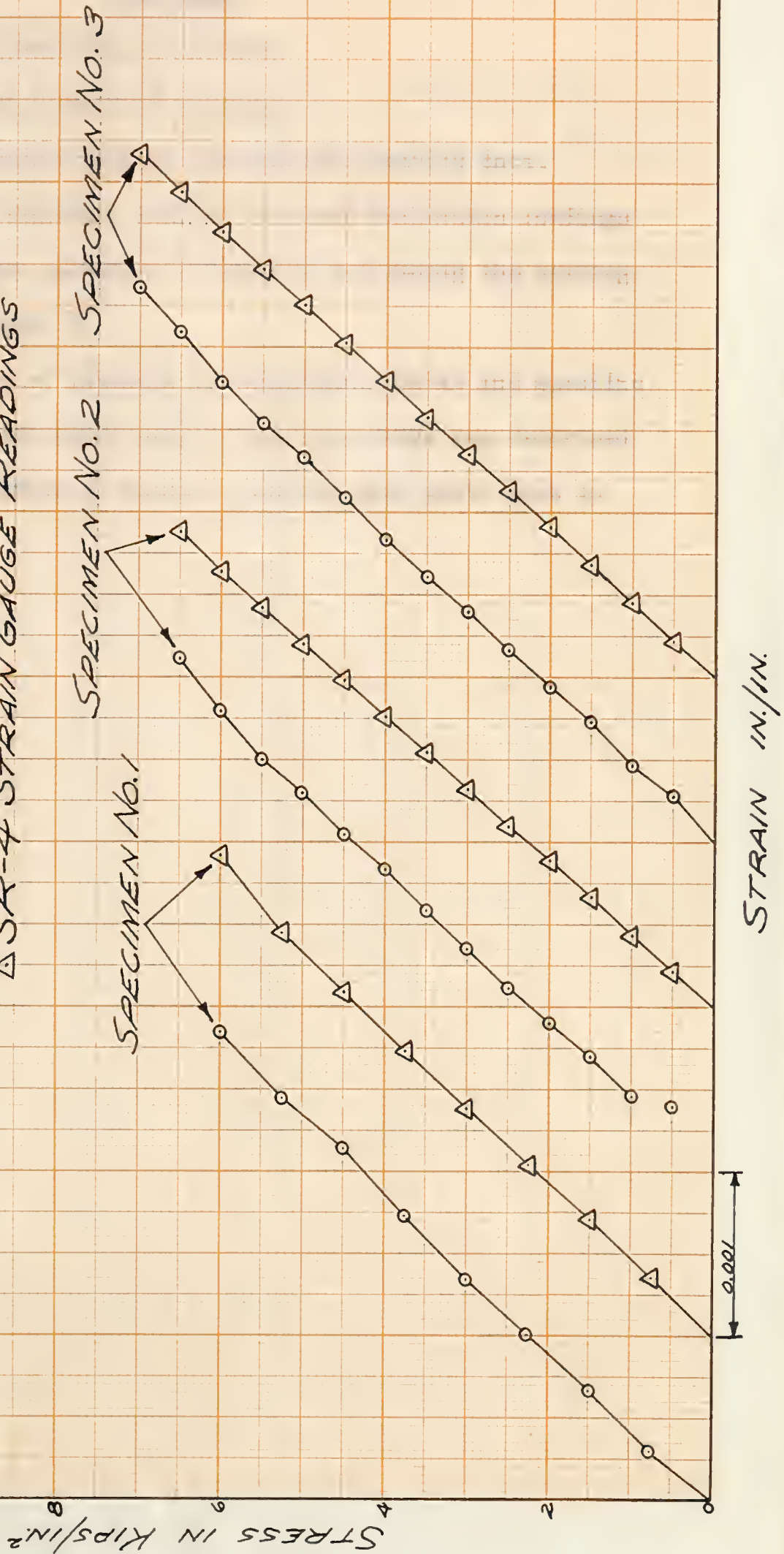


FIGURE 19
STRESS-STRAIN CURVES OF SMALL DOUGLAS FIR
COMPRESSION SPECIMENS
○ MERCER DIAL READINGS
△ SR-4 STRAIN GAUGE READINGS





A 20-4 STAIN PAPER SPECIMEN
 OF WEARER DIA BEADING
 COMPRESSION SPECIMEN
 AT 2000 PSI TO 2000 PSI OF STAIN PAPER
 FIBRE 10

APPENDIX DTEST DATA

Test data are presented as follows:

- (1) Load deflection readings.
- (2) Moisture content and specific gravity data.

The left dial and right dial in the load deflection readings are referred to a person standing in front of and facing the testing machine as shown in Figure 3.

For the purpose of labeling the moisture content and specific gravity samples, the side plate next to the bolt heads was described as Piece 1, the main member as Piece 2, and the side plate next to the nuts as Piece 3.

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UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-1 DATE OF TEST August 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:36 a.m. END 9:44 a.m.
 AVERAGE MOISTURE CONTENT 10.8% AVERAGE SPECIFIC GRAVITY .507

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 21 000 | .2379 | .2330 | .1355 |
| 1 000 | .1002 | .1004 | .0003 | 22 000 | .2448 | .2400 | .1424 |
| 2 000 | .1010 | .1009 | .0010 | 23 000 | .2522 | .2475 | .1499 |
| 3 000 | .1197 | .1195 | .0196 | 24 000 | .2595 | .2540 | .1568 |
| 4 000 | .1350 | .1345 | .0347 | 25 000 | .2673 | .2620 | .1646 |
| 5 000 | .1430 | .1410 | .0420 | 26 000 | .2757 | .2700 | .1728 |
| 6 000 | .1513 | .1495 | .0504 | 27 000 | .2838 | .2780 | .1809 |
| 7 000 | .1580 | .1565 | .0572 | 28 000 | .2930 | .2870 | .1900 |
| 8 000 | .1637 | .1675 | .0656 | 29 000 | .3022 | .2965 | .1994 |
| 9 000 | .1688 | ..... | .0688 | 30 000 | .3120 | .3060 | .2090 |
| 10 000 | .1738 | .1725 | .0732 | 31 000 | .3225 | .3110 | .2168 |
| 11 000 | .1792 | .1770 | .0781 | 32 000 | .3330 | .3270 | .2300 |
| 12 000 | .1851 | .1830 | .0840 | 33 000 | .3440 | .3380 | .2410 |
| 13 000 | .1916 | .1890 | .0903 | 34 000 | .3568 | .3560 | .2564 |
| 14 000 | .1980 | .1950 | .0965 | 35 000 | .3708 | .3660 | .2684 |
| 15 000 | .2040 | .2005 | .1022 | 36 000 | .3860 | .3800 | .2830 |
| 16 000 | .2098 | .2060 | .1078 | 37 000 | .4012 | .3960 | .2986 |
| 17 000 | .2152 | .2110 | .1131 | 37 350 | .4170 | .4110 | .3140 |
| 18 000 | .2208 | .2160 | .1184 | 38 000 | .4273 | .4205 | .3239 |
| 19 000 | .2260 | .2210 | .1235 | 38 650 | .4500 | .4400 | .3450 |
| 20 000 | .2316 | .2265 | .1290 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on left bolt line and slightly on right
 bolt line.
 Piece 2 failed on right bolt line and slightly on left bolt
 line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-2 DATE OF TEST August 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:54 a.m. END 10:04 a.m.
 AVERAGE MOISTURE CONTENT 12.3% AVERAGE SPECIFIC GRAVITY .451

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 21 000 | .1545 | .2568 | .1557 |
| 1 000 | .0003 | .1005 | .0004 | 22 000 | .1630 | .2650 | .1640 |
| 2 000 | .0008 | .1007 | .0007 | 23 000 | .1718 | .2770 | .1744 |
| 3 000 | .0011 | .1009 | .0010 | 24 000 | .1810 | .2820 | .1815 |
| 4 000 | .0018 | .1012 | .0015 | 25 000 | .1900 | .2905 | .1902 |
| 5 000 | .0030 | .1019 | .0025 | 26 000 | .1997 | .3000 | .1999 |
| 6 000 | .0135 | .1140 | .0137 | 27 000 | .2100 | .3090 | .2095 |
| 7 000 | .0238 | .1245 | .0242 | 28 000 | .2206 | .3195 | .2200 |
| 8 000 | .0350 | .1365 | .0357 | 29 000 | .2317 | .3310 | .2313 |
| 9 000 | .0440 | .1450 | .0445 | 30 000 | .2438 | .3420 | .2429 |
| 10 000 | .0542 | .1550 | .0546 | 31 000 | .2558 | .3535 | .2547 |
| 11 000 | .0655 | .1655 | .0655 | 32 000 | .2738 | .3715 | .2727 |
| 12 000 | .0785 | .1785 | .0785 | 32 950 | .2920 | .3895 | .2908 |
| 13 000 | .0888 | .1880 | .0884 | 33 000 | .3133 | .4120 | .3127 |
| 14 000 | .0973 | .1980 | .0977 | 33 550 | .3280 | .4280 | .3280 |
| 15 000 | .1046 | .2055 | .1051 | 34 000 | .3590 | .4580 | .3585 |
| 16 000 | .1125 | .2135 | .1130 | 35 000 | .3860 | .4750 | .3805 |
| 17 000 | .1210 | .2225 | .1217 | 35 550 | -- | .5295 | .4295 |
| 18 000 | .1293 | .2310 | .1301 | | | | |
| 19 000 | .1373 | .2390 | .1381 | | | | |
| 20 000 | .1460 | .2485 | .1472 | | | | |

REMARKS: Slight dial jumping and cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on right bolt line (which was cracked very slightly
 before test).

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-3 DATE OF TEST August 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:22 a.m. END 10:32 a.m.
 AVERAGE MOISTURE CONTENT 11.3% AVERAGE SPECIFIC GRAVITY .526

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2190 | .2320 | .1255 |
| 1 000 | .1001 | .1002 | .0001 | 23 000 | .2255 | .2385 | .1320 |
| 2 000 | .1003 | .1005 | .0004 | 24 000 | .2322 | .2450 | .1386 |
| 3 000 | .1007 | .1010 | .0008 | 25 000 | .2392 | .2520 | .1456 |
| 4 000 | .1100 | .1120 | .0110 | 26 000 | .2463 | .2585 | .1524 |
| 5 000 | .1260 | .1295 | .0278 | 27 000 | .2538 | .2660 | .1599 |
| 6 000 | .1345 | .1370 | .0357 | 28 000 | .2620 | .2740 | .1680 |
| 7 000 | .1410 | .1440 | .0425 | 29 000 | .2708 | .2820 | .1764 |
| 8 000 | .1470 | .1505 | .0488 | 30 000 | .2793 | .2905 | .1849 |
| 9 000 | .1525 | .1570 | .0548 | 31 000 | .2897 | .3010 | .1953 |
| 10 000 | .1577 | .1625 | .0601 | 32 000 | .3002 | .3120 | .2061 |
| 11 000 | .1622 | .1690 | .0656 | 33 000 | .3106 | .3220 | .2163 |
| 12 000 | .1671 | .1745 | .0708 | 34 000 | .3228 | .3335 | .2281 |
| 13 000 | .1717 | .1795 | .0756 | 35 000 | .3360 | .3450 | .2405 |
| 14 000 | .1762 | .1845 | .0803 | 36 000 | .3507 | .3580 | .2544 |
| 15 000 | .1810 | .1900 | .0855 | 37 000 | .3703 | .3755 | .2729 |
| 16 000 | .1861 | .1955 | .0908 | 37 450 | .3808 | .3830 | .2819 |
| 17 000 | .1910 | .2015 | .0962 | 38 000 | .4080 | .4020 | .3050 |
| 18 000 | .1960 | .2070 | .1015 | 38 900 | .4470 | .4320 | .3495 |
| 19 000 | .2010 | .2130 | .1070 | 39 000 | .4703 | .4520 | .3611 |
| 20 000 | .2070 | .2190 | .1130 | 39 500 | .5300 | -- | .4300 |
| 21 000 | .2128 | .2255 | .1191 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on both bolt lines.
 Piece 2 failed on right bolt line.
 Piece 3 failed on left bolt line and slightly on right bolt line.

RECAPITULATION

of the results of the various experiments

conducted during the year

| Experiment I | | | | Experiment II | | | |
|-------------------------|------|-------|----------|--------------------------|------|-------|----------|
| Results of Experiment I | | | | Results of Experiment II | | | |
| No. | Time | Temp. | Pressure | No. | Time | Temp. | Pressure |
| 1 | 10.0 | 20.0 | 100.0 | 1 | 10.0 | 20.0 | 100.0 |
| 2 | 10.5 | 20.5 | 100.5 | 2 | 10.5 | 20.5 | 100.5 |
| 3 | 11.0 | 21.0 | 101.0 | 3 | 11.0 | 21.0 | 101.0 |
| 4 | 11.5 | 21.5 | 101.5 | 4 | 11.5 | 21.5 | 101.5 |
| 5 | 12.0 | 22.0 | 102.0 | 5 | 12.0 | 22.0 | 102.0 |
| 6 | 12.5 | 22.5 | 102.5 | 6 | 12.5 | 22.5 | 102.5 |
| 7 | 13.0 | 23.0 | 103.0 | 7 | 13.0 | 23.0 | 103.0 |
| 8 | 13.5 | 23.5 | 103.5 | 8 | 13.5 | 23.5 | 103.5 |
| 9 | 14.0 | 24.0 | 104.0 | 9 | 14.0 | 24.0 | 104.0 |
| 10 | 14.5 | 24.5 | 104.5 | 10 | 14.5 | 24.5 | 104.5 |
| 11 | 15.0 | 25.0 | 105.0 | 11 | 15.0 | 25.0 | 105.0 |
| 12 | 15.5 | 25.5 | 105.5 | 12 | 15.5 | 25.5 | 105.5 |
| 13 | 16.0 | 26.0 | 106.0 | 13 | 16.0 | 26.0 | 106.0 |
| 14 | 16.5 | 26.5 | 106.5 | 14 | 16.5 | 26.5 | 106.5 |
| 15 | 17.0 | 27.0 | 107.0 | 15 | 17.0 | 27.0 | 107.0 |
| 16 | 17.5 | 27.5 | 107.5 | 16 | 17.5 | 27.5 | 107.5 |
| 17 | 18.0 | 28.0 | 108.0 | 17 | 18.0 | 28.0 | 108.0 |
| 18 | 18.5 | 28.5 | 108.5 | 18 | 18.5 | 28.5 | 108.5 |
| 19 | 19.0 | 29.0 | 109.0 | 19 | 19.0 | 29.0 | 109.0 |
| 20 | 19.5 | 29.5 | 109.5 | 20 | 19.5 | 29.5 | 109.5 |
| 21 | 20.0 | 30.0 | 110.0 | 21 | 20.0 | 30.0 | 110.0 |
| 22 | 20.5 | 30.5 | 110.5 | 22 | 20.5 | 30.5 | 110.5 |
| 23 | 21.0 | 31.0 | 111.0 | 23 | 21.0 | 31.0 | 111.0 |
| 24 | 21.5 | 31.5 | 111.5 | 24 | 21.5 | 31.5 | 111.5 |
| 25 | 22.0 | 32.0 | 112.0 | 25 | 22.0 | 32.0 | 112.0 |
| 26 | 22.5 | 32.5 | 112.5 | 26 | 22.5 | 32.5 | 112.5 |
| 27 | 23.0 | 33.0 | 113.0 | 27 | 23.0 | 33.0 | 113.0 |
| 28 | 23.5 | 33.5 | 113.5 | 28 | 23.5 | 33.5 | 113.5 |
| 29 | 24.0 | 34.0 | 114.0 | 29 | 24.0 | 34.0 | 114.0 |
| 30 | 24.5 | 34.5 | 114.5 | 30 | 24.5 | 34.5 | 114.5 |
| 31 | 25.0 | 35.0 | 115.0 | 31 | 25.0 | 35.0 | 115.0 |
| 32 | 25.5 | 35.5 | 115.5 | 32 | 25.5 | 35.5 | 115.5 |
| 33 | 26.0 | 36.0 | 116.0 | 33 | 26.0 | 36.0 | 116.0 |
| 34 | 26.5 | 36.5 | 116.5 | 34 | 26.5 | 36.5 | 116.5 |
| 35 | 27.0 | 37.0 | 117.0 | 35 | 27.0 | 37.0 | 117.0 |
| 36 | 27.5 | 37.5 | 117.5 | 36 | 27.5 | 37.5 | 117.5 |
| 37 | 28.0 | 38.0 | 118.0 | 37 | 28.0 | 38.0 | 118.0 |
| 38 | 28.5 | 38.5 | 118.5 | 38 | 28.5 | 38.5 | 118.5 |
| 39 | 29.0 | 39.0 | 119.0 | 39 | 29.0 | 39.0 | 119.0 |
| 40 | 29.5 | 39.5 | 119.5 | 40 | 29.5 | 39.5 | 119.5 |
| 41 | 30.0 | 40.0 | 120.0 | 41 | 30.0 | 40.0 | 120.0 |
| 42 | 30.5 | 40.5 | 120.5 | 42 | 30.5 | 40.5 | 120.5 |
| 43 | 31.0 | 41.0 | 121.0 | 43 | 31.0 | 41.0 | 121.0 |
| 44 | 31.5 | 41.5 | 121.5 | 44 | 31.5 | 41.5 | 121.5 |
| 45 | 32.0 | 42.0 | 122.0 | 45 | 32.0 | 42.0 | 122.0 |
| 46 | 32.5 | 42.5 | 122.5 | 46 | 32.5 | 42.5 | 122.5 |
| 47 | 33.0 | 43.0 | 123.0 | 47 | 33.0 | 43.0 | 123.0 |
| 48 | 33.5 | 43.5 | 123.5 | 48 | 33.5 | 43.5 | 123.5 |
| 49 | 34.0 | 44.0 | 124.0 | 49 | 34.0 | 44.0 | 124.0 |
| 50 | 34.5 | 44.5 | 124.5 | 50 | 34.5 | 44.5 | 124.5 |

Summary of results of the various experiments

conducted during the year

conducted during the year

conducted during the year

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-4 DATE OF TEST August 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:46 a.m. END 10:55 a.m.
 AVERAGE MOISTURE CONTENT 10.7% AVERAGE SPECIFIC GRAVITY .515

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2294 | .2445 | .1369 |
| 1 000 | .1000 | .1004 | .0002 | 23 000 | .2356 | .2520 | .1438 |
| 2 000 | .1001 | .1009 | .0005 | 24 000 | .2421 | .2590 | .1505 |
| 3 000 | .1007 | .1048 | .0028 | 25 000 | .2487 | .2665 | .1576 |
| 4 000 | .1072 | .1160 | .0116 | 26 000 | .2568 | .2750 | .1659 |
| 5 000 | .1210 | .1300 | .0255 | 27 000 | .2648 | .2840 | .1744 |
| 6 000 | .1310 | .1410 | .0360 | 28 000 | .2737 | .2935 | .1836 |
| 7 000 | .1378 | .1485 | .0431 | 29 000 | .2830 | .3035 | .1933 |
| 8 000 | .1432 | .1545 | .0489 | 30 000 | .2918 | .3130 | .2024 |
| 9 000 | .1486 | .1610 | .0548 | 31 000 | .3021 | .3240 | .2130 |
| 10 000 | .1550 | .1670 | .0610 | 32 000 | .3134 | .3360 | .2247 |
| 11 000 | .1610 | .1730 | .0670 | 33 000 | .3270 | .3510 | .2390 |
| 12 000 | .1677 | .1790 | .0733 | 34 000 | .3472 | .3705 | .2588 |
| 13 000 | .1743 | .1855 | .0799 | 35 000 | .3660 | .3870 | .2765 |
| 14 000 | .1808 | .1915 | .0861 | 36 000 | .3850 | .4050 | .2950 |
| 15 000 | .1870 | .1980 | .0925 | 37 000 | .4180 | .4320 | .3250 |
| 16 000 | .1934 | .2045 | .0989 | 37 950 | .5210 | .5180 | .4195 |
| 17 000 | .2007 | .2115 | .1061 | | | | |
| 18 000 | .2073 | .2185 | .1129 | | | | |
| 19 000 | .2135 | .2255 | .1195 | | | | |
| 20 000 | .2188 | .2320 | .1254 | | | | |
| 21 000 | .2243 | .2385 | .1314 | | | | |

REMARKS: No dial jumping or cracking noise.
 All pieces failed on both bolt lines.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-5 DATE OF TEST August 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:03 a.m. END 11:10 a.m.
 AVERAGE MOISTURE CONTENT 11.1% AVERAGE SPECIFIC GRAVITY .516

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2573 | .2645 | .1609 |
| 1 000 | .1003 | .1004 | .0004 | 23 000 | .2652 | .2730 | .1691 |
| 2 000 | .1027 | .1035 | .0031 | 24 000 | .2735 | .2820 | .1777 |
| 3 000 | .1170 | .1205 | .0188 | 25 000 | .2812 | .2910 | .1859 |
| 4 000 | .1410 | .1420 | .0415 | 26 000 | .2895 | .3005 | .1950 |
| 5 000 | .1532 | .1520 | .0526 | 27 000 | .2982 | .3100 | .2041 |
| 6 000 | .1620 | .1600 | .0610 | 28 000 | .3088 | .3210 | .2149 |
| 7 000 | .1700 | .1665 | .0682 | 29 000 | .3186 | .3310 | .2248 |
| 8 000 | .1780 | .1730 | .0755 | 30 000 | .3310 | .3430 | .2370 |
| 9 000 | .1858 | .1790 | .0824 | 31 000 | .3438 | .3550 | .2494 |
| 10 000 | .1928 | .1860 | .0894 | 32 000 | .3690 | .3820 | .2755 |
| 11 000 | .1988 | .1925 | .0957 | 33 000 | .3790 | .3990 | .2890 |
| 12 000 | .2057 | .2005 | .1031 | 33 300 | .3850 | .4070 | .2960 |
| 13 000 | .2118 | .2075 | .1097 | | | | |
| 14 000 | .2170 | .2135 | .1152 | | | | |
| 15 000 | .2221 | .2200 | .1210 | | | | |
| 16 000 | .2263 | .2260 | .1261 | | | | |
| 17 000 | .2310 | .2320 | .1315 | | | | |
| 18 000 | .2354 | .2380 | .1367 | | | | |
| 19 000 | .2398 | .2435 | .1417 | | | | |
| 20 000 | .2448 | .2500 | .1474 | | | | |
| 21 000 | .2504 | .2565 | .1534 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on right bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on both bolt lines.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-6 DATE OF TEST August 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:22 a.m. END 11:30 a.m.
 AVERAGE MOISTURE CONTENT 13.8% AVERAGE SPECIFIC GRAVITY .473

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 22 000 | .3729 | .2460 | .1594 |
| 1 000 | .2004 | .1002 | .0003 | 23 000 | .3818 | .2530 | .1674 |
| 2 000 | .2011 | .1002 | .0007 | 24 000 | .3907 | .2605 | .1756 |
| 3 000 | .2019 | .1005 | .0012 | 25 000 | .3998 | .2680 | .1839 |
| 4 000 | .2028 | .1005 | .0017 | 26 000 | .4091 | .2765 | .1928 |
| 5 000 | .2068 | .1005 | .0037 | 27 000 | .4188 | .2845 | .2016 |
| 6 000 | .2186 | .1070 | .0128 | 28 000 | .4292 | .2935 | .2113 |
| 7 000 | .2307 | .1200 | .0253 | 29 000 | .4403 | .3035 | .2219 |
| 8 000 | .2430 | .1330 | .0380 | 30 000 | .4522 | .3140 | .2331 |
| 9 000 | .2542 | .1415 | .0478 | 31 000 | .4621 | .3225 | .2423 |
| 10 000 | .2641 | .1490 | .0565 | 32 000 | .4742 | .3335 | .2538 |
| 11 000 | .2750 | .1585 | .0667 | 33 000 | .4876 | .3465 | .2670 |
| 12 000 | .2848 | .1685 | .0766 | 34 000 | .5022 | .3600 | .2811 |
| 13 000 | .2936 | .1770 | .0853 | 35 000 | .5158 | .3730 | .2944 |
| 14 000 | .3020 | .1855 | .0937 | 36 000 | .5320 | .3885 | .3102 |
| 15 000 | .3110 | .1940 | .1025 | 37 000 | .5482 | .4040 | .3261 |
| 16 000 | .3198 | .2020 | .1109 | 38 000 | .5680 | .4230 | .3455 |
| 17 000 | .3288 | .2095 | .1191 | 39 000 | .5910 | .4430 | .3670 |
| 18 000 | .3373 | .2165 | .1269 | 39 800 | .6150 | -- | .4150 |
| 19 000 | .3462 | .2235 | .1348 | | | | |
| 20 000 | .3552 | .2315 | .1433 | | | | |
| 21 000 | .3640 | .2380 | .1510 | | | | |

REMARKS: No dial jumping or cracking noise.
 All pieces split on both bolt lines.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-7 DATE OF TEST August 19, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:21 a.m. END 9:29 a.m.
 AVERAGE MOISTURE CONTENT 11.8% AVERAGE SPECIFIC GRAVITY 0.517

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2380 | .2205 | .1292 |
| 1 000 | .1000 | .1000 | .0000 | 23 000 | .2432 | .2265 | .1348 |
| 2 000 | .1001 | .1001 | .0001 | 24 000 | .2486 | .2325 | .1405 |
| 3 000 | .1005 | .1002 | .0003 | 25 000 | .2545 | .2385 | .1465 |
| 4 000 | .1060 | .1005 | .0033 | 26 000 | .2602 | .2445 | .1523 |
| 5 000 | .1177 | .1078 | .0127 | 27 000 | .2665 | .2510 | .1587 |
| 6 000 | .1260 | .1135 | .0197 | 28 000 | .2741 | .2585 | .1663 |
| 7 000 | .1370 | .1225 | .0297 | 29 000 | .2814 | .2655 | .1734 |
| 8 000 | .1480 | .1325 | .0402 | 30 000 | .2888 | .2735 | .1811 |
| 9 000 | .1588 | .1440 | .0514 | 31 000 | .2968 | .2820 | .1894 |
| 10 000 | .1687 | .1530 | .0608 | 32 000 | .3170 | .2970 | .2070 |
| 11 000 | .1752 | .1595 | .0673 | 33 000 | .3375 | .3155 | .2265 |
| 12 000 | .1812 | .1650 | .0731 | 34 000 | .3540 | .3420 | .2480 |
| 13 000 | .1872 | .1705 | .0788 | 35 000 | .3690 | .3740 | .2715 |
| 14 000 | .1928 | .1755 | .0841 | 35 700 | .4100 | .4300 | .3200 |
| 15 000 | .1983 | .1810 | .0896 | | | | |
| 16 000 | .2040 | .1860 | .0950 | | | | |
| 17 000 | .2098 | .1920 | .1009 | | | | |
| 18 000 | .2157 | .1980 | .1068 | | | | |
| 19 000 | .2216 | .2050 | .1133 | | | | |
| 20 000 | .2272 | .2100 | .1186 | | | | |
| 21 000 | .2328 | .2150 | .1239 | | | | |

REMARKS: Very slight cracking noise and dial jumping.
 Pieces 1 and 3 failed on right bolt line.
 Piece 2 failed on left bolt line.
 Piece 1 failed slightly on left bolt line.

TABLE 1
 SUMMARY OF THE DATA
 FOR THE STUDY

| Year 1994 | | | | Year 1995 | | | |
|-----------|-----------|-----|-------|-----------|-----------|-----|-------|
| Total | | | | Total | | | |
| Year | Age | Sex | Group | Year | Age | Sex | Group |
| 1994 | 18-24 | M | 100 | 1995 | 18-24 | M | 100 |
| 1994 | 25-34 | M | 100 | 1995 | 25-34 | M | 100 |
| 1994 | 35-44 | M | 100 | 1995 | 35-44 | M | 100 |
| 1994 | 45-54 | M | 100 | 1995 | 45-54 | M | 100 |
| 1994 | 55-64 | M | 100 | 1995 | 55-64 | M | 100 |
| 1994 | 65-74 | M | 100 | 1995 | 65-74 | M | 100 |
| 1994 | 75-84 | M | 100 | 1995 | 75-84 | M | 100 |
| 1994 | 85-94 | M | 100 | 1995 | 85-94 | M | 100 |
| 1994 | 95-104 | M | 100 | 1995 | 95-104 | M | 100 |
| 1994 | 105-114 | M | 100 | 1995 | 105-114 | M | 100 |
| 1994 | 115-124 | M | 100 | 1995 | 115-124 | M | 100 |
| 1994 | 125-134 | M | 100 | 1995 | 125-134 | M | 100 |
| 1994 | 135-144 | M | 100 | 1995 | 135-144 | M | 100 |
| 1994 | 145-154 | M | 100 | 1995 | 145-154 | M | 100 |
| 1994 | 155-164 | M | 100 | 1995 | 155-164 | M | 100 |
| 1994 | 165-174 | M | 100 | 1995 | 165-174 | M | 100 |
| 1994 | 175-184 | M | 100 | 1995 | 175-184 | M | 100 |
| 1994 | 185-194 | M | 100 | 1995 | 185-194 | M | 100 |
| 1994 | 195-204 | M | 100 | 1995 | 195-204 | M | 100 |
| 1994 | 205-214 | M | 100 | 1995 | 205-214 | M | 100 |
| 1994 | 215-224 | M | 100 | 1995 | 215-224 | M | 100 |
| 1994 | 225-234 | M | 100 | 1995 | 225-234 | M | 100 |
| 1994 | 235-244 | M | 100 | 1995 | 235-244 | M | 100 |
| 1994 | 245-254 | M | 100 | 1995 | 245-254 | M | 100 |
| 1994 | 255-264 | M | 100 | 1995 | 255-264 | M | 100 |
| 1994 | 265-274 | M | 100 | 1995 | 265-274 | M | 100 |
| 1994 | 275-284 | M | 100 | 1995 | 275-284 | M | 100 |
| 1994 | 285-294 | M | 100 | 1995 | 285-294 | M | 100 |
| 1994 | 295-304 | M | 100 | 1995 | 295-304 | M | 100 |
| 1994 | 305-314 | M | 100 | 1995 | 305-314 | M | 100 |
| 1994 | 315-324 | M | 100 | 1995 | 315-324 | M | 100 |
| 1994 | 325-334 | M | 100 | 1995 | 325-334 | M | 100 |
| 1994 | 335-344 | M | 100 | 1995 | 335-344 | M | 100 |
| 1994 | 345-354 | M | 100 | 1995 | 345-354 | M | 100 |
| 1994 | 355-364 | M | 100 | 1995 | 355-364 | M | 100 |
| 1994 | 365-374 | M | 100 | 1995 | 365-374 | M | 100 |
| 1994 | 375-384 | M | 100 | 1995 | 375-384 | M | 100 |
| 1994 | 385-394 | M | 100 | 1995 | 385-394 | M | 100 |
| 1994 | 395-404 | M | 100 | 1995 | 395-404 | M | 100 |
| 1994 | 405-414 | M | 100 | 1995 | 405-414 | M | 100 |
| 1994 | 415-424 | M | 100 | 1995 | 415-424 | M | 100 |
| 1994 | 425-434 | M | 100 | 1995 | 425-434 | M | 100 |
| 1994 | 435-444 | M | 100 | 1995 | 435-444 | M | 100 |
| 1994 | 445-454 | M | 100 | 1995 | 445-454 | M | 100 |
| 1994 | 455-464 | M | 100 | 1995 | 455-464 | M | 100 |
| 1994 | 465-474 | M | 100 | 1995 | 465-474 | M | 100 |
| 1994 | 475-484 | M | 100 | 1995 | 475-484 | M | 100 |
| 1994 | 485-494 | M | 100 | 1995 | 485-494 | M | 100 |
| 1994 | 495-504 | M | 100 | 1995 | 495-504 | M | 100 |
| 1994 | 505-514 | M | 100 | 1995 | 505-514 | M | 100 |
| 1994 | 515-524 | M | 100 | 1995 | 515-524 | M | 100 |
| 1994 | 525-534 | M | 100 | 1995 | 525-534 | M | 100 |
| 1994 | 535-544 | M | 100 | 1995 | 535-544 | M | 100 |
| 1994 | 545-554 | M | 100 | 1995 | 545-554 | M | 100 |
| 1994 | 555-564 | M | 100 | 1995 | 555-564 | M | 100 |
| 1994 | 565-574 | M | 100 | 1995 | 565-574 | M | 100 |
| 1994 | 575-584 | M | 100 | 1995 | 575-584 | M | 100 |
| 1994 | 585-594 | M | 100 | 1995 | 585-594 | M | 100 |
| 1994 | 595-604 | M | 100 | 1995 | 595-604 | M | 100 |
| 1994 | 605-614 | M | 100 | 1995 | 605-614 | M | 100 |
| 1994 | 615-624 | M | 100 | 1995 | 615-624 | M | 100 |
| 1994 | 625-634 | M | 100 | 1995 | 625-634 | M | 100 |
| 1994 | 635-644 | M | 100 | 1995 | 635-644 | M | 100 |
| 1994 | 645-654 | M | 100 | 1995 | 645-654 | M | 100 |
| 1994 | 655-664 | M | 100 | 1995 | 655-664 | M | 100 |
| 1994 | 665-674 | M | 100 | 1995 | 665-674 | M | 100 |
| 1994 | 675-684 | M | 100 | 1995 | 675-684 | M | 100 |
| 1994 | 685-694 | M | 100 | 1995 | 685-694 | M | 100 |
| 1994 | 695-704 | M | 100 | 1995 | 695-704 | M | 100 |
| 1994 | 705-714 | M | 100 | 1995 | 705-714 | M | 100 |
| 1994 | 715-724 | M | 100 | 1995 | 715-724 | M | 100 |
| 1994 | 725-734 | M | 100 | 1995 | 725-734 | M | 100 |
| 1994 | 735-744 | M | 100 | 1995 | 735-744 | M | 100 |
| 1994 | 745-754 | M | 100 | 1995 | 745-754 | M | 100 |
| 1994 | 755-764 | M | 100 | 1995 | 755-764 | M | 100 |
| 1994 | 765-774 | M | 100 | 1995 | 765-774 | M | 100 |
| 1994 | 775-784 | M | 100 | 1995 | 775-784 | M | 100 |
| 1994 | 785-794 | M | 100 | 1995 | 785-794 | M | 100 |
| 1994 | 795-804 | M | 100 | 1995 | 795-804 | M | 100 |
| 1994 | 805-814 | M | 100 | 1995 | 805-814 | M | 100 |
| 1994 | 815-824 | M | 100 | 1995 | 815-824 | M | 100 |
| 1994 | 825-834 | M | 100 | 1995 | 825-834 | M | 100 |
| 1994 | 835-844 | M | 100 | 1995 | 835-844 | M | 100 |
| 1994 | 845-854 | M | 100 | 1995 | 845-854 | M | 100 |
| 1994 | 855-864 | M | 100 | 1995 | 855-864 | M | 100 |
| 1994 | 865-874 | M | 100 | 1995 | 865-874 | M | 100 |
| 1994 | 875-884 | M | 100 | 1995 | 875-884 | M | 100 |
| 1994 | 885-894 | M | 100 | 1995 | 885-894 | M | 100 |
| 1994 | 895-904 | M | 100 | 1995 | 895-904 | M | 100 |
| 1994 | 905-914 | M | 100 | 1995 | 905-914 | M | 100 |
| 1994 | 915-924 | M | 100 | 1995 | 915-924 | M | 100 |
| 1994 | 925-934 | M | 100 | 1995 | 925-934 | M | 100 |
| 1994 | 935-944 | M | 100 | 1995 | 935-944 | M | 100 |
| 1994 | 945-954 | M | 100 | 1995 | 945-954 | M | 100 |
| 1994 | 955-964 | M | 100 | 1995 | 955-964 | M | 100 |
| 1994 | 965-974 | M | 100 | 1995 | 965-974 | M | 100 |
| 1994 | 975-984 | M | 100 | 1995 | 975-984 | M | 100 |
| 1994 | 985-994 | M | 100 | 1995 | 985-994 | M | 100 |
| 1994 | 995-1004 | M | 100 | 1995 | 995-1004 | M | 100 |
| 1994 | 1005-1014 | M | 100 | 1995 | 1005-1014 | M | 100 |
| 1994 | 1015-1024 | M | 100 | 1995 | 1015-1024 | M | 100 |
| 1994 | 1025-1034 | M | 100 | 1995 | 1025-1034 | M | 100 |
| 1994 | 1035-1044 | M | 100 | 1995 | 1035-1044 | M | 100 |
| 1994 | 1045-1054 | M | 100 | 1995 | 1045-1054 | M | 100 |
| 1994 | 1055-1064 | M | 100 | 1995 | 1055-1064 | M | 100 |
| 1994 | 1065-1074 | M | 100 | 1995 | 1065-1074 | M | 100 |
| 1994 | 1075-1084 | M | 100 | 1995 | 1075-1084 | M | 100 |
| 1994 | 1085-1094 | M | 100 | 1995 | 1085-1094 | M | 100 |
| 1994 | 1095-1104 | M | 100 | 1995 | 1095-1104 | M | 100 |
| 1994 | 1105-1114 | M | 100 | 1995 | 1105-1114 | M | 100 |
| 1994 | 1115-1124 | M | 100 | 1995 | 1115-1124 | M | 100 |
| 1994 | 1125-1134 | M | 100 | 1995 | 1125-1134 | M | 100 |
| 1994 | 1135-1144 | M | 100 | 1995 | 1135-1144 | M | 100 |
| 1994 | 1145-1154 | M | 100 | 1995 | 1145-1154 | M | 100 |
| 1994 | 1155-1164 | M | 100 | 1995 | 1155-1164 | M | 100 |
| 1994 | 1165-1174 | M | 100 | 1995 | 1165-1174 | M | 100 |
| 1994 | 1175-1184 | M | 100 | 1995 | 1175-1184 | M | 100 |
| 1994 | 1185-1194 | M | 100 | 1995 | 1185-1194 | M | 100 |
| 1994 | 1195-1204 | M | 100 | 1995 | 1195-1204 | M | 100 |
| 1994 | 1205-1214 | M | 100 | 1995 | 1205-1214 | M | 100 |
| 1994 | 1215-1224 | M | 100 | 1995 | 1215-1224 | M | 100 |
| 1994 | 1225-1234 | M | 100 | 1995 | 1225-1234 | M | 100 |
| 1994 | 1235-1244 | M | 100 | 1995 | 1235-1244 | M | 100 |
| 1994 | 1245-1254 | M | 100 | 1995 | 1245-1254 | M | 100 |
| 1994 | 1255-1264 | M | 100 | 1995 | 1255-1264 | M | 100 |
| 1994 | 1265-1274 | M | 100 | 1995 | 1265-1274 | M | 100 |
| 1994 | 1275-1284 | M | 100 | 1995 | 1275-1284 | M | 100 |
| 1994 | 1285-1294 | M | 100 | 1995 | 1285-1294 | M | 100 |
| 1994 | 1295-1304 | M | 100 | 1995 | 1295-1304 | M | 100 |
| 1994 | 1305-1314 | M | 100 | 1995 | 1305-1314 | M | 100 |
| 1994 | 1315-1324 | M | 100 | 1995 | 1315-1324 | M | 100 |
| 1994 | 1325-1334 | M | 100 | 1995 | 1325-1334 | M | 100 |
| 1994 | 1335-1344 | M | 100 | 1995 | 1335-1344 | M | 100 |
| 1994 | 1345-1354 | M | 100 | 1995 | 1345-1354 | M | 100 |
| 1994 | 1355-1364 | M | 100 | 1995 | 1355-1364 | M | 100 |
| 1994 | 1365-1374 | M | 100 | 1995 | 1365-1374 | M | 100 |
| 1994 | 1375-1384 | M | 100 | 1995 | 1375-1384 | M | 100 |
| 1994 | 1385-1394 | M | 100 | 1995 | 1385-1394 | M | 100 |
| 1994 | 1395-1404 | M | 100 | 1995 | 1395-1404 | M | 100 |
| 1994 | 1405-1414 | M | 100 | 1995 | 1405-1414 | M | 100 |
| 1994 | 1415-1424 | M | 100 | 1995 | 1415-1424 | M | 100 |
| 1994 | 1425-1434 | M | 100 | 1995 | 1425-1434 | M | 100 |
| 1994 | 1435-1444 | M | 100 | 1995 | 1435-1444 | M | 100 |
| 1994 | 1445-1454 | M | 100 | 1995 | 1445-1454 | M | 100 |
| 1994 | 1455-1464 | M | 100 | 1995 | 1455-1464 | M | 100 |
| 1994 | 1465-1474 | M | 100 | 1995 | 1465-1474 | M | 100 |
| 1994 | 1475-1484 | M | 100 | 1995 | 1475-1484 | M | 100 |
| 1994 | 1485-1494 | M | 100 | 1995 | 1485-1494 | M | 100 |
| 1994 | 1495-1504 | M | 100 | 1995 | 1495-1504 | M | 100 |
| 1994 | 1505-1514 | M | 100 | 1995 | 1505-1514 | M | 100 |
| 1994 | 1515-1524 | M | 100 | 1995 | 1515-1524 | M | 100 |
| 1994 | 1525-1534 | M | 100 | 1995 | 1525-1534 | M | 100 |
| 1994 | 1535-1544 | M | 100 | 1995 | 1535-1544 | M | 100 |
| 1994 | 1545-1554 | M | 100 | 1995 | 1545-1554 | M | 100 |
| 1994 | 1555-1564 | M | 100 | 1995 | 1555-1564 | M | 100 |
| 1994 | 1565-1574 | M | 100 | 1995 | 1565-1574 | M | 100 |
| 1994 | 1575-1584 | M | 100 | 1995 | 1575-1584 | M | 100 |
| 1994 | 1585-1594 | M | 100 | 1995 | 1585-1594 | M | 100 |
| 1994 | 1595-1604 | M | 100 | 1995 | 1595-1604 | M | 100 |
| 1994 | 1605-1614 | M | 100 | 1995 | | | |

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-8DATE OF TEST: August 19, 1959RATE OF LOADING 5,000 LB./MIN.TIME: BEGIN 9:38 a.m. END 9:46 a.m.AVERAGE MOISTURE CONTENT 11.9%AVERAGE SPECIFIC GRAVITY 0.472

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2377 | .2435 | .1406 |
| 1 000 | .1003 | .1002 | .0002 | 23 000 | .2464 | .2525 | .1494 |
| 2 000 | .1008 | .1005 | .0007 | 24 000 | .2548 | .2610 | .1579 |
| 3 000 | .1010 | .1012 | .0011 | 25 000 | .2635 | .2700 | .1667 |
| 4 000 | .1018 | .1025 | .0022 | 26 000 | .2720 | .2780 | .1750 |
| 5 000 | .1077 | .1090 | .0083 | 27 000 | .2817 | .2870 | .1843 |
| 6 000 | .1168 | .1190 | .0179 | 28 000 | .2904 | .2960 | .1932 |
| 7 000 | .1240 | .1280 | .0260 | 29 000 | .3012 | .3065 | .2038 |
| 8 000 | .1323 | .1380 | .0351 | 30 000 | .3127 | -- | .2127 |
| 9 000 | .1402 | .1460 | .0431 | 31 000 | .3241 | .3290 | .2266 |
| 10 000 | .1472 | .1530 | .0501 | 32 000 | .3364 | .3420 | .2392 |
| 11 000 | .1547 | .1620 | .0583 | 33 000 | .3500 | .3550 | .2525 |
| 12 000 | .1617 | .1690 | .0653 | 34 000 | .3638 | .3690 | .2664 |
| 13 000 | .1678 | .1755 | .0716 | 35 000 | .3783 | .3840 | .2811 |
| 14 000 | .1746 | .1820 | .0783 | 35 550 | .3900 | .3980 | .2940 |
| 15 000 | .1817 | .1890 | .0853 | | | | |
| 16 000 | .1893 | .1965 | .0929 | | | | |
| 17 000 | .1973 | .2040 | .1006 | | | | |
| 18 000 | .2056 | .2120 | .1088 | | | | |
| 19 000 | .2135 | .2200 | .1167 | | | | |
| 20 000 | .2218 | .2275 | .1246 | | | | |
| 21 000 | .2293 | .2350 | .1321 | | | | |

REMARKS: Very slight dial jumping and cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-9 DATE OF TEST August 19, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:54 a.m. END 10:04 a.m.
 AVERAGE MOISTURE CONTENT 12.4% AVERAGE SPECIFIC GRAVITY 0.591

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .0000 | .0000 | 23 000 | .2302 | .1125 | .1213 |
| 1 000 | .1002 | .0001 | .0001 | 24 000 | .2358 | .1170 | .1264 |
| 2 000 | .1005 | .0004 | .0005 | 25 000 | .2410 | .1215 | .1312 |
| 3 000 | .1009 | .0009 | .0009 | 26 000 | .2463 | .1260 | .1361 |
| 4 000 | .1174 | .0150 | .0162 | 27 000 | .2521 | .1308 | .1415 |
| 5 000 | .1268 | .0230 | .0249 | 28 000 | .2580 | .1355 | .1467 |
| 6 000 | .1322 | .0288 | .0305 | 29 000 | .2643 | .1410 | .1526 |
| 7 000 | .1393 | .0360 | .0376 | 30 000 | .2707 | .1465 | .1586 |
| 8 000 | .1473 | .0430 | .0452 | 31 000 | .2770 | .1520 | .1645 |
| 9 000 | .1562 | .0505 | .0533 | 32 000 | .2838 | .1585 | .1711 |
| 10 000 | .1640 | .0575 | .0607 | 33 000 | .2911 | .1648 | .1779 |
| 11 000 | .1714 | .0635 | .0674 | 34 000 | .2987 | .1715 | .1851 |
| 12 000 | .1773 | .0695 | .0734 | 35 000 | .3067 | .1785 | .1926 |
| 13 000 | .1829 | .0740 | .0784 | 36 000 | .3143 | .1850 | .1996 |
| 14 000 | .1878 | .0785 | .0831 | 37 000 | .3231 | .1930 | .2080 |
| 15 000 | .1927 | .0825 | .0876 | 38 000 | .3312 | .2005 | .2158 |
| 16 000 | .1975 | .0865 | .0920 | 39 000 | .3416 | .2100 | .2258 |
| 17 000 | .2027 | .0905 | .0966 | 40 000 | .3530 | .2200 | .2365 |
| 18 000 | .2065 | .0935 | .1000 | 40 550 | .3640 | .2270 | .2455 |
| 19 000 | .2110 | .0975 | .1042 | 41 000 | .3817 | .2430 | .2623 |
| 20 000 | .2156 | .1010 | .1083 | 42 000 | .3963 | .2575 | .2769 |
| 21 000 | .2204 | .1050 | .1127 | 43 000 | .4140 | .2740 | .2940 |
| 22 000 | .2253 | .1090 | .1171 | 43 500 | .4320 | .2910 | .3115 |

REMARKS: Very slight dial jumping and cracking noise.
 All pieces failed on both bolt lines.
 Right bolt line was the major failure.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-10 DATE OF TEST August 19, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:25 a.m. END 10:34 a.m.
 AVERAGE MOISTURE CONTENT 12.9% AVERAGE SPECIFIC GRAVITY 0.476

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2400 | .2575 | .1487 |
| 1 000 | .1002 | .1001 | .0001 | 24 000 | .2478 | .2655 | .1566 |
| 2 000 | .1007 | .1008 | .0007 | 25 000 | .2555 | .2735 | .1645 |
| 3 000 | .1008 | .1010 | .0009 | 26 000 | .2640 | .2815 | .1727 |
| 4 000 | .1011 | .1018 | .0015 | 27 000 | .2728 | .2900 | .1814 |
| 5 000 | .1071 | .1110 | .0090 | 28 000 | .2819 | .2995 | .1907 |
| 6 000 | .1140 | .1210 | .0175 | 29 000 | .2914 | .3085 | .2000 |
| 7 000 | .1220 | .1310 | .0265 | 30 000 | .3009 | .3175 | .2092 |
| 8 000 | .1300 | .1395 | .0347 | 31 000 | .3117 | .3290 | .2203 |
| 9 000 | .1395 | .1490 | .0442 | 32 000 | .3228 | .3405 | .2316 |
| 10 000 | .1490 | .1600 | .0545 | 33 000 | .3348 | .3530 | .2439 |
| 11 000 | .1570 | .1690 | .0630 | 34 000 | .3483 | .3670 | .2576 |
| 12 000 | .1630 | .1760 | .0695 | 35 000 | .3643 | .3825 | .2734 |
| 13 000 | .1685 | .1820 | .0752 | 36 000 | .3800 | .3980 | .2890 |
| 14 000 | .1748 | .1885 | .0816 | 37 000 | .3978 | .4150 | .3064 |
| 15 000 | .1822 | .1965 | .0893 | 37 100 | .4060 | .4240 | .3150 |
| 16 000 | .1890 | .2035 | .0962 | 38 000 | .4680 | .4940 | .3810 |
| 17 000 | .1958 | .2100 | .1029 | 39 000 | .5010 | .5250 | .4130 |
| 18 000 | .2028 | .2170 | .1099 | 39 250 | .5390 | .5650 | .4520 |
| 19 000 | .2100 | .2260 | .1180 | | | | |
| 20 000 | .2172 | .2335 | .1253 | | | | |
| 21 000 | .2248 | .2420 | .1334 | | | | |
| 22 000 | .2323 | .2495 | .1409 | | | | |

REMARKS: Very slight dial jumping and cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on right bolt line.

Summary of the results of the
analysis of the data of the
first group of cases

The results of the analysis of the data of the first group of cases are summarized in the following table. The table shows the number of cases in each of the four groups, the number of cases in each of the four groups, and the number of cases in each of the four groups.

| Group | Number of cases | Number of cases | Number of cases | Number of cases | Number of cases | Number of cases | Number of cases |
|-------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 4 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 5 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 7 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 8 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 11 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 12 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 13 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 14 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 15 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 16 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 17 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 18 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 19 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 20 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 21 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 22 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 23 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 24 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 25 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 26 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 27 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 28 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 29 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 30 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 31 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 32 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 33 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 34 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 35 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 36 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 37 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 38 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 39 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 40 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 41 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 42 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 43 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 44 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 45 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 46 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 47 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 48 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 49 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 50 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 51 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 52 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 53 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 54 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 55 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 56 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 57 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 58 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 59 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 60 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 61 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 62 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 63 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 64 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 65 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 66 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 67 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 68 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 69 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 70 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 71 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 72 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 73 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 74 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 75 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 76 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 77 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 78 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 79 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 80 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 81 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 82 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 83 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 84 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 85 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 86 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 87 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 88 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 89 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 90 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 91 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 92 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 93 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 94 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 95 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 96 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 97 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 98 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 99 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 100 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

The results of the analysis of the data of the first group of cases are summarized in the following table. The table shows the number of cases in each of the four groups, the number of cases in each of the four groups, and the number of cases in each of the four groups.

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-11 DATE OF TEST August 19, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:46 a.m. END 10:55 a.m.
 AVERAGE MOISTURE CONTENT 12.8% AVERAGE SPECIFIC GRAVITY 0.645

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-----------------------------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2338 | .2400 | .1369 |
| 1 000 | .1003 | .1002 | .0002 | 24 000 | .2392 | .2455 | .1423 |
| 2 000 | .1008 | .1005 | .0006 | 25 000 | .2447 | .2500 | .1473 |
| 3 000 | .1011 | .1008 | .0010 | 26 000 | .2500 | .2550 | .1525 |
| 4 000 | .1023 | .1014 | .0018 | 27 000 | .2555 | .2600 | .1577 |
| 5 000 | .1115 | .1170 | .0142 | 28 000 | .2613 | .2655 | .1634 |
| 6 000 | .1194 | .1275 | .0234 | 29 000 | .2670 | .2705 | .1687 |
| 7 000 | .1296 | .1420 | .0358 | 30 000 | .2732 | .2765 | .1748 |
| 8 000 | .1383 | .1530 | .0456 | 31 000 | .2800 | .2820 | .1810 |
| 9 000 | .1451 | .1595 | .0523 | 32 000 | .2867 | .2880 | .1873 |
| 10 000 | .1521 | .1665 | .0593 | 33 000 | .2934 | .2940 | .1937 |
| 11 000 | .1608 | .1755 | .0681 | 34 000 | .3004 | .3005 | .2004 |
| 12 000 | .1696 | .1840 | .0768 | 35 000 | .3072 | .3065 | .2068 |
| 13 000 | .1771 | .1910 | .0840 | 36 000 | .3148 | .3130 | .2139 |
| 14 000 | .1848 | .1975 | .0911 | 37 000 | .3237 | .3210 | .2223 |
| 15 000 | .1907 | .2025 | .0966 | 38 000 | .3325 | .3290 | .2307 |
| 16 000 | .1968 | .2070 | .1014 | 39 000 | .3432 | .3400 | .2416 |
| 17 000 | .2023 | .2120 | .1071 | 40 000 | .3560 | .3520 | .2540 |
| 18 000 | .2082 | .2175 | .1128 | 41 000 | .3671 | .3630 | .2650 |
| 19 000 | .2130 | .2215 | .1172 | | | | |
| 20 000 | .2180 | .2260 | .1220 | | | | |
| 21 000 | .2231 | .2305 | .1268 | To be continued on next page..... | | | |
| 22 000 | .2283 | .2350 | .1316 | | | | |

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-12 DATE OF TEST August 19, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:05 a.m. END 11:13 a.m.
 AVERAGE MOISTURE CONTENT 11.8% AVERAGE SPECIFIC GRAVITY 0.575

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2183 | .2455 | .1319 |
| 1 000 | .1000 | .1000 | .0000 | 24 000 | .2242 | .2525 | .1383 |
| 2 000 | .1000 | .1002 | .0001 | 25 000 | .2300 | .2595 | .1447 |
| 3 000 | .1001 | .1005 | .0003 | 26 000 | .2359 | .2660 | .1509 |
| 4 000 | .1225 | .1315 | .0270 | 27 000 | .2417 | .2730 | .1573 |
| 5 000 | .1312 | .1450 | .0381 | 28 000 | .2490 | .2810 | .1650 |
| 6 000 | .1360 | .1550 | .0455 | 29 000 | .2556 | .2890 | .1723 |
| 7 000 | .1407 | .1615 | .0511 | 30 000 | .2627 | .2965 | .1796 |
| 8 000 | .1452 | .1680 | .0566 | 31 000 | .2700 | .3040 | .1870 |
| 9 000 | .1495 | .1730 | .0612 | 32 000 | .2777 | .3125 | .1951 |
| 10 000 | .1540 | .1800 | .0670 | 33 000 | .2860 | .3215 | .2037 |
| 11 000 | .1582 | .1850 | .0716 | 34 000 | .2953 | .3320 | .2136 |
| 12 000 | .1630 | .1905 | .0767 | 35 000 | .3091 | .3470 | .2280 |
| 13 000 | .1684 | .1960 | .0822 | 36 000 | .3230 | .3610 | .2420 |
| 14 000 | .1733 | .2005 | .0869 | 37 000 | .3382 | .3770 | .2576 |
| 15 000 | .1780 | .2040 | .0910 | 37 100 | .3430 | .3800 | .2615 |
| 16 000 | .1821 | .2085 | .0953 | 38 000 | .3595 | .3985 | .2790 |
| 17 000 | .1868 | .2120 | .0994 | 39 000 | .3830 | .4210 | .3020 |
| 18 000 | .1914 | .2170 | .1042 | 39 550 | .4330 | .4620 | .3475 |
| 19 000 | .1962 | .2210 | .1086 | | | | |
| 20 000 | .2014 | .2270 | .1142 | | | | |
| 21 000 | .2067 | .2325 | .1196 | | | | |
| 22 000 | .2127 | .2390 | .1258 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on left bolt line.
 Piece 2 failed on both bolt lines.

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: A-13 DATE OF TEST August 24, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:08 p.m. END 2:16 p.m.
 AVERAGE MOISTURE CONTENT 12.3% AVERAGE SPECIFIC GRAVITY 0.461

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .2000 | .0000 | 23 000 | .2430 | .3600 | .1515 |
| 1 000 | .1003 | .2002 | .0002 | 24 000 | .2510 | .3685 | .1597 |
| 2 000 | .1008 | .2006 | .0007 | 25 000 | .2595 | .3720 | .1657 |
| 3 000 | .1011 | .2012 | .0012 | 26 000 | .2680 | .3860 | .1770 |
| 4 000 | .1020 | .2028 | .0024 | 27 000 | .2766 | .3955 | .1860 |
| 5 000 | .1043 | .2085 | .0064 | 28 000 | .2852 | .4055 | .1953 |
| 6 000 | .1110 | .2125 | .0117 | 29 000 | .2944 | .4150 | .2047 |
| 7 000 | .1213 | .2295 | .0254 | 30 000 | .3045 | .4260 | .2152 |
| 8 000 | .1380 | .2485 | .0432 | 31 000 | .3157 | .4375 | .2266 |
| 9 000 | .1510 | .2620 | .0565 | 32 000 | .3280 | .4500 | .2390 |
| 10 000 | .1582 | .2700 | .0641 | 33 000 | .3410 | .4640 | .2525 |
| 11 000 | .1647 | .2770 | .0708 | 34 000 | .3550 | .4735 | .2642 |
| 12 000 | .1702 | .2830 | .0766 | 35 000 | .3700 | .4935 | .2817 |
| 13 000 | .1767 | .2895 | .0831 | 36 000 | .3860 | .5110 | .2985 |
| 14 000 | .1815 | .2945 | .0880 | 37 000 | .4080 | .5345 | .3212 |
| 15 000 | .1870 | .3000 | .0935 | 38 000 | .4304 | .5570 | .3437 |
| 16 000 | .1923 | .3060 | .0991 | 38 950 | .4640 | .5870 | .3755 |
| 17 000 | .1980 | .3120 | .1050 | | | | |
| 18 000 | .2046 | .3195 | .1120 | | | | |
| 19 000 | .2117 | .3275 | .1196 | | | | |
| 20 000 | .2192 | .3350 | .1271 | | | | |
| 21 000 | .2271 | .3435 | .1353 | | | | |
| 22 000 | .2350 | .3520 | .1435 | | | | |

REMARKS: Slight cracking noise and dial jumping.
 Pieces 1 and 3 failed on left bolt line and failed slightly on
 right bolt line.
 Piece 2 failed on right bolt line.

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BOLTED JOINT TESTS

JOINT NO: A-14 DATE OF TEST August 24, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:22 p.m. END 2:30 p.m.
 AVERAGE MOISTURE CONTENT 11.0% AVERAGE SPECIFIC GRAVITY 0.508

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 23 000 | .3368 | .2245 | .1306 |
| 1 000 | .2003 | .1002 | .0003 | 24 000 | .3426 | .2300 | .1363 |
| 2 000 | .2010 | .1005 | .0007 | 25 000 | .3485 | .2365 | .1425 |
| 3 000 | .2030 | .1012 | .0021 | 26 000 | .3554 | .2430 | .1492 |
| 4 000 | .2136 | .1150 | .0143 | 27 000 | .3624 | .2495 | .1559 |
| 5 000 | .2248 | .1270 | .0259 | 28 000 | .3717 | .2595 | .1656 |
| 6 000 | .2323 | .1345 | .0334 | 29 000 | .3800 | .2680 | .1740 |
| 7 000 | .2427 | .1430 | .0428 | 30 000 | .3925 | .2800 | .1862 |
| 8 000 | .2540 | .1525 | .0532 | 31 000 | .4032 | .2895 | .1963 |
| 9 000 | .2642 | .1610 | .0626 | 32 000 | .4178 | .3025 | .2101 |
| 10 000 | .2717 | .1665 | .0691 | 33 000 | .4342 | .3165 | .2253 |
| 11 000 | .2778 | .1710 | .0744 | 34 000 | .4578 | .3360 | .2469 |
| 12 000 | .2830 | .1750 | .0790 | 35 000 | .4762 | .3480 | .2621 |
| 13 000 | .2882 | .1795 | .0838 | 36 000 | .5235 | .3745 | .2990 |
| 14 000 | .2930 | .1835 | .0883 | 36 200 | .5360 | -- | -- |
| 15 000 | .2975 | .1875 | .0925 | | | | |
| 16 000 | .3017 | .1915 | .0966 | | | | |
| 17 000 | .3061 | .1950 | .1005 | | | | |
| 18 000 | .3102 | .1995 | .1048 | | | | |
| 19 000 | .3147 | .2035 | .1091 | | | | |
| 20 000 | .3192 | .2080 | .1136 | | | | |
| 21 000 | .3247 | .2130 | .1188 | | | | |
| 22 000 | .3304 | .2185 | .1244 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on left bolt line.
 Piece 2 failed on both bolt lines but right bolt line was major failure.
 Piece 3 failed on both bolt lines but left bolt line was major failure.

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BOLTED JOINT TESTS

JOINT NO: A-15 DATE OF TEST August 24, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:38 p.m. END 2:46 p.m.
 AVERAGE MOISTURE CONTENT 11.4% AVERAGE SPECIFIC GRAVITY 0.604

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 22 000 | .3335 | .2285 | .1310 |
| 1 000 | .2002 | .1002 | .0002 | 23 000 | .3390 | .2330 | .1360 |
| 2 000 | .2005 | .1004 | .0004 | 24 000 | .3447 | .2375 | .1411 |
| 3 000 | .2009 | .1005 | .0007 | 25 000 | .3513 | .2430 | .1472 |
| 4 000 | .2027 | .1010 | .0018 | 26 000 | .3582 | .2490 | .1536 |
| 5 000 | .2200 | .1170 | .0185 | 27 000 | .3660 | .2560 | .1610 |
| 6 000 | .2380 | .1340 | .0360 | 28 000 | .3750 | .2635 | .1692 |
| 7 000 | .2490 | .1460 | .0475 | 29 000 | .3837 | .2715 | .1776 |
| 8 000 | .2570 | .1535 | .0553 | 30 000 | .3940 | .2805 | .1872 |
| 9 000 | .2647 | .1600 | .0623 | 31 000 | .4090 | .2935 | .2012 |
| 10 000 | .2710 | .1660 | .0685 | 32 000 | .4280 | .3130 | .2205 |
| 11 000 | .2778 | .1735 | .0756 | 33 000 | .4656 | .3375 | .2515 |
| 12 000 | .2837 | .1790 | .0814 | 34 000 | .4900 | .3550 | .2725 |
| 13 000 | .2888 | .1850 | .0869 | 34 650 | .5580 | .4020 | .3300 |
| 14 000 | .2939 | .1900 | .0920 | | | | |
| 15 000 | .2987 | .1950 | .0969 | | | | |
| 16 000 | .3034 | .1995 | .1015 | | | | |
| 17 000 | .3080 | .2045 | .1063 | | | | |
| 18 000 | .3129 | .2095 | .1112 | | | | |
| 19 000 | .3177 | .2150 | .1189 | | | | |
| 20 000 | .3228 | .2195 | .1212 | | | | |
| 21 000 | .3280 | .2240 | .1260 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 2 failed on both bolt lines.
 Piece 3 failed on left bolt line.

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-1 DATE OF TEST June 10, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:12 p.m. END 2:20 p.m.
 AVERAGE MOISTURE CONTENT 23.7% AVERAGE SPECIFIC GRAVITY 0.509

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 26 000 | .3842 | .2870 | .1856 |
| 500 | .2002 | .1000 | .0001 | 28 000 | .4080 | .3140 | .2110 |
| 1 000 | .2004 | .1000 | .0002 | 30 000 | .4360 | .3445 | .2402 |
| 1 500 | .2008 | .1000 | .0004 | 32 000 | .4717 | .3815 | .2766 |
| 2 000 | .2050 | .1025 | .0037 | 33 000 | .4930 | .4045 | .2987 |
| 2 500 | -- | -- | -- | 34 000 | .5190 | .4310 | .3250 |
| 3 000 | -- | -- | -- | 35 000 | .5440 | .4570 | .3505 |
| 3 500 | -- | -- | -- | 36 000 | .5762 | .4900 | .3831 |
| 4 000 | .2275 | .1222 | .0248 | 37 000 | .6102 | .5250 | .4176 |
| 4 500 | .2360 | .1330 | .0345 | 38 000 | .6635 | .5790 | .4712 |
| 5 000 | .2458 | .1375 | .0416 | 38 750 | .7347 | .6530 | .5438 |
| 5 500 | .2511 | .1450 | .0480 | | | | |
| 6 000 | .2550 | .1500 | .0525 | | | | |
| 8 000 | .2811 | .1725 | .0768 | | | | |
| 10 000 | .2978 | .1875 | .0926 | | | | |
| 12 000 | .3090 | .1990 | .1040 | | | | |
| 14 000 | .3178 | .2080 | .1129 | | | | |
| 16 000 | .3254 | .2175 | .1214 | | | | |
| 18 000 | .3330 | .2260 | .1295 | | | | |
| 20 000 | .3413 | .2360 | .1386 | | | | |
| 22 000 | .3512 | .2480 | .1496 | | | | |
| 24 000 | .3660 | .2660 | .1660 | | | | |

REMARKS: Considerable dial jumping and cracking noise.
 Piece 2 failed on right bolt line.

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BOLTED JOINT TESTS

JOINT NO: B-2 DATE OF TEST June 10, 1959RATE OF LOADING: 5,000 LB./MIN. TIME: BEGIN 2:34 p.m. END 2:46 p.m.AVERAGE MOISTURE CONTENT 24.9% AVERAGE SPECIFIC GRAVITY 0.475

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .0000 | .0000 | 26 000 | .1492 | .1410 | .1451 |
| 500 | .0000 | .0000 | .0000 | 28 000 | .1730 | .1660 | .1695 |
| 1 000 | .0000 | .0000 | .0000 | 30 000 | .2010 | .1970 | .1990 |
| 1 500 | .0000 | .0002 | .0001 | 32 000 | .2410 | .2390 | .2400 |
| 2 000 | .0003 | .0005 | .0004 | 33 000 | .2650 | .2650 | .2650 |
| 2 500 | .0005 | .0008 | .0006 | 34 000 | .2922 | .2930 | .2926 |
| 3 000 | .0008 | .0010 | .0009 | 35 000 | .3220 | .3220 | .3220 |
| 3 500 | .0010 | .0010 | .0010 | 36 000 | .3550 | .3570 | .3560 |
| 4 000 | .0013 | .0020 | .0016 | 37 000 | .3928 | .3950 | .3939 |
| 4 500 | .0018 | .0030 | .0024 | 38 000 | .4450 | .4470 | .4460 |
| 5 000 | .0024 | .0050 | .0037 | 39 000 | .5222 | .5275 | .5248 |
| 5 500 | .0038 | .0057 | .0047 | 39 250 | .5980 | .6030 | .6005 |
| 6 000 | .0133 | .0130 | .0131 | | | | |
| 8 000 | .0442 | .0410 | .0426 | | | | |
| 10 000 | .0558 | .0510 | .0534 | | | | |
| 12 000 | .0675 | .0608 | .0641 | | | | |
| 14 000 | .0785 | .0692 | .0738 | | | | |
| 16 000 | .0884 | .0775 | .0829 | | | | |
| 18 000 | .0978 | .0848 | .0913 | | | | |
| 20 000 | .1077 | .0945 | .1011 | | | | |
| 22 000 | .1180 | .1060 | .1120 | | | | |
| 24 000 | .1317 | .1210 | .1263 | | | | |

REMARKS: Considerable dial jumping and cracking noise.
 Piece 2 failed on left bolt line.

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-3 DATE OF TEST June 10, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 1:46 p.m. END 1:54 p.m.
 AVERAGE MOISTURE CONTENT 25.0% AVERAGE SPECIFIC GRAVITY 0.468

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 26 000 | .1658 | .2293 | .1475 |
| 500 | .0002 | .1000 | .0001 | 28 000 | .1922 | .2535 | .1728 |
| 1 000 | .0004 | .1000 | .0002 | 30 000 | .2192 | .2780 | .1986 |
| 1 500 | .0008 | .1000 | .0004 | 32 000 | .2620 | .3200 | .2410 |
| 2 000 | .0011 | .1000 | .0005 | 34 000 | .3090 | .3655 | .2872 |
| 2 500 | .0013 | .1001 | .0007 | 35 000 | .3392 | .3950 | .3171 |
| 3 000 | .0020 | .1001 | .0010 | 36 000 | .3780 | .4350 | .3565 |
| 3 500 | .0027 | .1002 | .0014 | 37 000 | .4242 | .4825 | .4033 |
| 4 000 | .0036 | -- | .0036 | 37 850 | .5160 | .5750 | .4955 |
| 4 500 | -- | -- | -- | | | | |
| 5 000 | .0122 | .1042 | .0082 | | | | |
| 5 500 | .0168 | .1060 | .0114 | | | | |
| 6 000 | .0211 | .1080 | .0145 | | | | |
| 8 000 | .0365 | .1165 | .0265 | | | | |
| 10 000 | .0517 | .1288 | .0402 | | | | |
| 12 000 | .0641 | .1398 | .0519 | | | | |
| 14 000 | .0742 | .1500 | .0621 | | | | |
| 16 000 | .0839 | .1595 | .0717 | | | | |
| 18 000 | .0952 | .1690 | .0821 | | | | |
| 20 000 | .1067 | .1785 | .0926 | | | | |
| 22 000 | .1230 | .1925 | .1077 | | | | |
| 24 000 | .1431 | .2095 | .1263 | | | | |

REMARKS: Considerable dial jumping and cracking noise.
 Piece 1 failed on right bolt line.
 Piece 2 failed slightly on right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-4 DATE OF TEST July 28, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 1:46 p.m. END 1:58 p.m.AVERAGE MOISTURE CONTENT 22.4% AVERAGE SPECIFIC GRAVITY .485

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .3000 | .2000 | .0000 | 22 000 | .4341 | .3580 | .1460 |
| 1 000 | .3002 | .2005 | .0003 | 23 000 | .4432 | .3675 | .1553 |
| 2 000 | .3003 | .2010 | .0006 | 24 000 | .4530 | .3790 | .1660 |
| 3 000 | .3008 | .2025 | .0016 | 25 000 | .4638 | .3910 | .1774 |
| 4 000 | .3010 | .2050 | .0030 | 26 000 | .4743 | .4030 | .1886 |
| 5 000 | .3058 | .2120 | .0089 | 27 000 | .4862 | .4165 | .2013 |
| 6 000 | .3115 | .2240 | .0177 | 28 000 | .4977 | .4300 | .2138 |
| 7 000 | .3173 | .2320 | .0246 | 29 000 | .5113 | .4450 | .2281 |
| 8 000 | .3246 | .2395 | .0320 | 30 000 | .5261 | .4610 | .2435 |
| 9 000 | .3331 | .2480 | .0405 | 31 000 | .5418 | .4725 | .2571 |
| 10 000 | .3435 | .2585 | .0510 | 32 000 | .5593 | .4965 | .2779 |
| 11 000 | .3508 | .2660 | .0584 | 33 000 | .5750 | .5125 | .2937 |
| 12 000 | .3571 | .2735 | .0653 | 34 000 | .5918 | .5300 | .3109 |
| 13 000 | .3650 | .2815 | .0732 | 35 000 | .6130 | .5520 | .3325 |
| 14 000 | .3731 | .2900 | .0815 | 36 000 | .6360 | .5770 | .3565 |
| 15 000 | .3812 | .2990 | .0901 | 37 000 | .6590 | .6020 | .3805 |
| 16 000 | .3903 | .3075 | .0989 | 38 000 | .6840 | .6270 | .4055 |
| 17 000 | .3982 | .3170 | .1076 | 39 000 | .7085 | .6540 | .4312 |
| 18 000 | .4058 | .3250 | .1154 | 40 000 | .7420 | .6870 | .4645 |
| 19 000 | .4130 | .3335 | .1232 | 41 000 | .7870 | .7350 | .5110 |
| 20 000 | .4198 | .3415 | .1306 | 41 250 | .8140 | .7680 | .5410 |
| 21 000 | .4262 | .3495 | .1378 | | | | |

REMARKS: No cracking noise or dial jumping.
All pieces failed on right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-5 DATE OF TEST July 28, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:22 p.m. END 2:33 p.m.AVERAGE MOISTURE CONTENT 22.5% AVERAGE SPECIFIC GRAVITY .461

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .3000 | .0000 | 22 000 | .3818 | .4750 | .1784 |
| 1 000 | .2003 | .3002 | .0003 | 23 000 | .3928 | .4850 | .1889 |
| 2 000 | .2010 | .3008 | .0009 | 24 000 | .4041 | .4960 | .2000 |
| 3 000 | .2026 | .3018 | .0022 | 25 000 | .4150 | .5070 | .2110 |
| 4 000 | .2190 | .3165 | .0177 | 26 000 | .4270 | .5190 | .2230 |
| 5 000 | .2285 | .3265 | .0275 | 27 000 | .4400 | .5320 | .2360 |
| 6 000 | .2370 | .3355 | .0362 | 28 000 | .4547 | .5460 | .2503 |
| 7 000 | .2471 | .3460 | .0465 | 29 000 | .4685 | .5600 | .2642 |
| 8 000 | .2578 | .3570 | .0574 | 30 000 | .4850 | .5760 | .2805 |
| 9 000 | .2662 | .3660 | .0661 | 31 000 | .5010 | .5920 | .2965 |
| 10 000 | .2741 | .3740 | .0740 | 32 000 | .5200 | .6110 | .3155 |
| 11 000 | .2820 | .3820 | .0820 | 33 000 | .5400 | .6320 | .3360 |
| 12 000 | .2897 | .3890 | .0893 | 34 000 | .5647 | .6550 | .3598 |
| 13 000 | .2973 | .3960 | .0966 | 35 000 | .5860 | .6760 | .3810 |
| 14 000 | .3051 | .4030 | .1040 | 36 000 | .6150 | .7040 | .4095 |
| 15 000 | .3132 | .4105 | .1118 | 37 000 | .6420 | .7320 | .4370 |
| 16 000 | .3216 | .4180 | .1198 | 38 000 | .6800 | .7700 | .4750 |
| 17 000 | .3312 | .4270 | .1291 | 39 000 | .7200 | .8095 | .5147 |
| 18 000 | .3408 | .4360 | .1384 | 40 000 | .7675 | .8565 | .5620 |
| 19 000 | .3506 | .4452 | .1479 | 41 000 | .8290 | .9190 | .6240 |
| 20 000 | .3613 | .4550 | .1581 | 41 500 | .8780 | .9700 | .6740 |
| 21 000 | .3712 | .4650 | .1681 | | | | |

REMARKS: No dial jumping or cracking noise.
All pieces cracked slightly under bolts.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-6 DATE OF TEST June 22, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:38 p.m. END 3:47 p.m.
 AVERAGE MOISTURE CONTENT 19.8% AVERAGE SPECIFIC GRAVITY 0.467

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2471 | .2550 | .1510 |
| 1 000 | .1001 | ..... | .0001 | 23 000 | .2552 | .2580 | .1566 |
| 2 000 | .1007 | ..... | .0007 | 24 000 | .2642 | .2675 | .1658 |
| 3 000 | .1020 | .1050 | .0035 | 25 000 | .2743 | .2750 | .1746 |
| 4 000 | .1268 | .1250 | .0259 | 26 000 | .2850 | .2865 | .1857 |
| 5 000 | .1415 | .1438 | .0426 | 27 000 | .2975 | .2980 | .1977 |
| 6 000 | .1518 | .1560 | .0539 | 28 000 | .3090 | .3100 | .2095 |
| 7 000 | .1588 | .1645 | .0616 | 29 000 | .3242 | .3270 | .2256 |
| 8 000 | .1670 | .1720 | .0695 | 30 000 | .3412 | .3465 | .2438 |
| 9 000 | .1750 | .1800 | .0775 | 31 000 | .3600 | .3600 | .2600 |
| 10 000 | .1828 | .1880 | .0854 | 32 000 | .3792 | .3810 | .2801 |
| 11 000 | .1879 | .1928 | .0903 | 33 000 | .4020 | .4000 | .3010 |
| 12 000 | .1923 | .1970 | .0946 | 34 000 | .4275 | .4275 | .3275 |
| 13 000 | .1967 | .2010 | .0988 | 35 000 | .4520 | .4500 | .3510 |
| 14 000 | .2008 | .2050 | .1029 | 36 000 | .4800 | .4780 | .3790 |
| 15 000 | .2050 | .2085 | .1067 | 37 000 | .5100 | .5070 | .4085 |
| 16 000 | .2090 | .2120 | .1105 | 38 000 | .5460 | .5425 | .4442 |
| 17 000 | .2142 | .2170 | .1156 | 38 950 | .6170 | .6110 | .5140 |
| 18 000 | .2198 | .2230 | .1214 | | | | |
| 19 000 | .2260 | .2290 | .1275 | | | | |
| 20 000 | .2320 | .2350 | .1335 | | | | |
| 21 000 | .2392 | .2420 | .1406 | | | | |

REMARKS: No sudden dial jumping or cracking noise.
 Piece 1 failed on both bolt lines.
 Piece 3 failed on right bolt line and slightly on left bolt line.
 Piece 2 was cracked on right bolt line before the test. This
 crack opened up very slightly during the test.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-7 DATE OF TEST June 22, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 4:00 P.M. END 4:09 p.m.AVERAGE MOISTURE CONTENT 19.5% AVERAGE SPECIFIC GRAVITY 0.470

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .2000 | .0000 | 22 000 | .2321 | .3525 | .1423 |
| 1 000 | .1002 | .2005 | .0003 | 23 000 | .2430 | .3620 | .1525 |
| 2 000 | .1003 | .2015 | .0009 | 24 000 | .2530 | .3730 | .1630 |
| 3 000 | .1007 | .2030 | .0018 | 25 000 | .2633 | .3830 | .1731 |
| 4 000 | .1010 | .2050 | .0030 | 26 000 | .2761 | .3950 | .1855 |
| 5 000 | .1118 | .2215 | .0166 | 27 000 | .2899 | .4080 | .1989 |
| 6 000 | .1260 | .2390 | .0325 | 28 000 | .3052 | .4240 | .2146 |
| 7 000 | .1388 | .2570 | .0479 | 29 000 | -- | -- | -- |
| 8 000 | .1480 | .2650 | .0565 | 30 000 | .3400 | .4590 | .2495 |
| 9 000 | .1587 | .2790 | .0688 | 31 000 | .3588 | .4770 | .2679 |
| 10 000 | .1649 | .2860 | .0754 | 32 000 | .3784 | .4960 | .2872 |
| 11 000 | .1696 | .2905 | .0800 | 33 000 | .4032 | .5210 | .3121 |
| 12 000 | .1723 | .2940 | .0831 | 34 000 | .4245 | .5430 | .3337 |
| 13 000 | .1772 | .2995 | .0883 | 35 000 | .4492 | .5665 | .3578 |
| 14 000 | .1817 | .3045 | .0931 | 36 000 | .4760 | .5935 | .3847 |
| 15 000 | .1858 | .3085 | .0971 | 37 000 | .5015 | .6200 | .4107 |
| 16 000 | .1898 | .3128 | .1013 | 38 000 | .5370 | .6550 | .4460 |
| 17 000 | .1947 | .3175 | .1061 | 39 000 | .6000 | .7180 | .5090 |
| 18 000 | .2005 | .3230 | .1117 | | | | |
| 19 000 | .2082 | .3300 | .1191 | | | | |
| 20 000 | .2157 | .3370 | .1263 | | | | |
| 21 000 | .2234 | .3450 | .1342 | | | | |

REMARKS: Moderate dial jumping; little cracking noise.
 Piece 1 failed on right bolt line, and failed slightly on left
 bolt line.
 Piece 3 failed slightly on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-8 DATE OF TEST July 28, 1959
 RATE OF LOADING 5,000 TIME: BEGIN 2:48 p.m. END 2:58 p.m.
 AVERAGE MOISTURE CONTENT 22.5% AVERAGE SPECIFIC GRAVITY .451

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .2820 | .2650 | .1735 |
| 1 000 | .1001 | .1002 | .0001 | 23 000 | .2930 | .2765 | .1847 |
| 2 000 | .1007 | .1005 | .0006 | 24 000 | .3030 | .2865 | .1947 |
| 3 000 | .1014 | .1008 | .0011 | 25 000 | .3155 | .2995 | .2075 |
| 4 000 | .1145 | .1030 | .0087 | 26 000 | .3280 | .3125 | .2202 |
| 5 000 | .1330 | .1260 | .0295 | 27 000 | .3422 | .3270 | .2346 |
| 6 000 | .1432 | .1345 | .0388 | 28 000 | .3588 | .3440 | .2514 |
| 7 000 | .1511 | .1410 | .0460 | 29 000 | .3752 | .3600 | .2676 |
| 8 000 | .1590 | .1470 | .0530 | 30 000 | .3938 | .3790 | .2864 |
| 9 000 | .1650 | .1520 | .0585 | 31 000 | .4120 | .3980 | .3050 |
| 10 000 | .1720 | .1575 | .0647 | 32 000 | .4320 | .4170 | .3245 |
| 11 000 | .1814 | .1650 | .0732 | 33 000 | .4528 | .4390 | .3459 |
| 12 000 | .1910 | .1710 | .0810 | 34 000 | .4770 | .4630 | .3700 |
| 13 000 | .2004 | .1800 | .0902 | 35 000 | .5010 | .4880 | .3945 |
| 14 000 | .2097 | .1890 | .0993 | 36 000 | .5290 | .5160 | .4225 |
| 15 000 | .2188 | .1985 | .1086 | 37 000 | .5600 | .5470 | .4535 |
| 16 000 | .2274 | .2075 | .1174 | 38 000 | .5980 | .5840 | .4910 |
| 17 000 | .2358 | .2170 | .1264 | 38 500 | .6300 | .6170 | .5235 |
| 18 000 | .2442 | .2260 | .1351 | | | | |
| 19 000 | .2527 | .2355 | .1441 | | | | |
| 20 000 | .2622 | .2455 | .1538 | | | | |
| 21 000 | .2720 | .2550 | .1635 | | | | |

REMARKS: No cracking noise or dial jumping.
 Piece 1 failed on left bolt line.
 Piece 2 failed on right bolt line.

TABLE III
 SUMMARY OF THE DATA
 FOR THE STUDY OF THE
 EFFECT OF THE TEMPERATURE
 ON THE RATE OF THE
 REACTION OF THE
 HYDROLYSIS OF THE
 ESTER OF THE
 ACID

| Time (min) | | | | Temperature (°C) | | | |
|------------|--|--|--|------------------|--|--|--|
| 100 | | | | 110 | | | |
| 120 | | | | 130 | | | |
| 140 | | | | 150 | | | |
| 160 | | | | 170 | | | |
| 180 | | | | 190 | | | |
| 200 | | | | 210 | | | |
| 220 | | | | 230 | | | |
| 240 | | | | 250 | | | |
| 260 | | | | 270 | | | |
| 280 | | | | 290 | | | |
| 300 | | | | 310 | | | |
| 320 | | | | 330 | | | |
| 340 | | | | 350 | | | |
| 360 | | | | 370 | | | |
| 380 | | | | 390 | | | |
| 400 | | | | 410 | | | |
| 420 | | | | 430 | | | |
| 440 | | | | 450 | | | |
| 460 | | | | 470 | | | |
| 480 | | | | 490 | | | |
| 500 | | | | 510 | | | |
| 520 | | | | 530 | | | |
| 540 | | | | 550 | | | |
| 560 | | | | 570 | | | |
| 580 | | | | 590 | | | |
| 600 | | | | 610 | | | |
| 620 | | | | 630 | | | |
| 640 | | | | 650 | | | |
| 660 | | | | 670 | | | |
| 680 | | | | 690 | | | |
| 700 | | | | 710 | | | |
| 720 | | | | 730 | | | |
| 740 | | | | 750 | | | |
| 760 | | | | 770 | | | |
| 780 | | | | 790 | | | |
| 800 | | | | 810 | | | |
| 820 | | | | 830 | | | |
| 840 | | | | 850 | | | |
| 860 | | | | 870 | | | |
| 880 | | | | 890 | | | |
| 900 | | | | 910 | | | |
| 920 | | | | 930 | | | |
| 940 | | | | 950 | | | |
| 960 | | | | 970 | | | |
| 980 | | | | 990 | | | |
| 1000 | | | | 1010 | | | |
| 1020 | | | | 1030 | | | |
| 1040 | | | | 1050 | | | |
| 1060 | | | | 1070 | | | |
| 1080 | | | | 1090 | | | |
| 1100 | | | | 1110 | | | |
| 1120 | | | | 1130 | | | |
| 1140 | | | | 1150 | | | |
| 1160 | | | | 1170 | | | |
| 1180 | | | | 1190 | | | |
| 1200 | | | | 1210 | | | |
| 1220 | | | | 1230 | | | |
| 1240 | | | | 1250 | | | |
| 1260 | | | | 1270 | | | |
| 1280 | | | | 1290 | | | |
| 1300 | | | | 1310 | | | |
| 1320 | | | | 1330 | | | |
| 1340 | | | | 1350 | | | |
| 1360 | | | | 1370 | | | |
| 1380 | | | | 1390 | | | |
| 1400 | | | | 1410 | | | |
| 1420 | | | | 1430 | | | |
| 1440 | | | | 1450 | | | |
| 1460 | | | | 1470 | | | |
| 1480 | | | | 1490 | | | |
| 1500 | | | | 1510 | | | |
| 1520 | | | | 1530 | | | |
| 1540 | | | | 1550 | | | |
| 1560 | | | | 1570 | | | |
| 1580 | | | | 1590 | | | |
| 1600 | | | | 1610 | | | |
| 1620 | | | | 1630 | | | |
| 1640 | | | | 1650 | | | |
| 1660 | | | | 1670 | | | |
| 1680 | | | | 1690 | | | |
| 1700 | | | | 1710 | | | |
| 1720 | | | | 1730 | | | |
| 1740 | | | | 1750 | | | |
| 1760 | | | | 1770 | | | |
| 1780 | | | | 1790 | | | |
| 1800 | | | | 1810 | | | |
| 1820 | | | | 1830 | | | |
| 1840 | | | | 1850 | | | |
| 1860 | | | | 1870 | | | |
| 1880 | | | | 1890 | | | |
| 1900 | | | | 1910 | | | |
| 1920 | | | | 1930 | | | |
| 1940 | | | | 1950 | | | |
| 1960 | | | | 1970 | | | |
| 1980 | | | | 1990 | | | |
| 2000 | | | | 2010 | | | |
| 2020 | | | | 2030 | | | |
| 2040 | | | | 2050 | | | |
| 2060 | | | | 2070 | | | |
| 2080 | | | | 2090 | | | |
| 2100 | | | | 2110 | | | |
| 2120 | | | | 2130 | | | |
| 2140 | | | | 2150 | | | |
| 2160 | | | | 2170 | | | |
| 2180 | | | | 2190 | | | |
| 2200 | | | | 2210 | | | |
| 2220 | | | | 2230 | | | |
| 2240 | | | | 2250 | | | |
| 2260 | | | | 2270 | | | |
| 2280 | | | | 2290 | | | |
| 2300 | | | | 2310 | | | |
| 2320 | | | | 2330 | | | |
| 2340 | | | | 2350 | | | |
| 2360 | | | | 2370 | | | |
| 2380 | | | | 2390 | | | |
| 2400 | | | | 2410 | | | |
| 2420 | | | | 2430 | | | |
| 2440 | | | | 2450 | | | |
| 2460 | | | | 2470 | | | |
| 2480 | | | | 2490 | | | |
| 2500 | | | | 2510 | | | |
| 2520 | | | | 2530 | | | |
| 2540 | | | | 2550 | | | |
| 2560 | | | | 2570 | | | |
| 2580 | | | | 2590 | | | |
| 2600 | | | | 2610 | | | |
| 2620 | | | | 2630 | | | |
| 2640 | | | | 2650 | | | |
| 2660 | | | | 2670 | | | |
| 2680 | | | | 2690 | | | |
| 2700 | | | | 2710 | | | |
| 2720 | | | | 2730 | | | |
| 2740 | | | | 2750 | | | |
| 2760 | | | | 2770 | | | |
| 2780 | | | | 2790 | | | |
| 2800 | | | | 2810 | | | |
| 2820 | | | | 2830 | | | |
| 2840 | | | | 2850 | | | |
| 2860 | | | | 2870 | | | |
| 2880 | | | | 2890 | | | |
| 2900 | | | | 2910 | | | |
| 2920 | | | | 2930 | | | |
| 2940 | | | | 2950 | | | |
| 2960 | | | | 2970 | | | |
| 2980 | | | | 2990 | | | |
| 3000 | | | | 3010 | | | |
| 3020 | | | | 3030 | | | |
| 3040 | | | | 3050 | | | |
| 3060 | | | | 3070 | | | |
| 3080 | | | | 3090 | | | |
| 3100 | | | | 3110 | | | |
| 3120 | | | | 3130 | | | |
| 3140 | | | | 3150 | | | |
| 3160 | | | | 3170 | | | |
| 3180 | | | | 3190 | | | |
| 3200 | | | | 3210 | | | |
| 3220 | | | | 3230 | | | |
| 3240 | | | | 3250 | | | |
| 3260 | | | | 3270 | | | |
| 3280 | | | | 3290 | | | |
| 3300 | | | | 3310 | | | |
| 3320 | | | | 3330 | | | |
| 3340 | | | | 3350 | | | |
| 3360 | | | | 3370 | | | |
| 3380 | | | | 3390 | | | |
| 3400 | | | | 3410 | | | |
| 3420 | | | | 3430 | | | |
| 3440 | | | | 3450 | | | |
| 3460 | | | | 3470 | | | |
| 3480 | | | | 3490 | | | |
| 3500 | | | | 3510 | | | |
| 3520 | | | | 3530 | | | |
| 3540 | | | | 3550 | | | |
| 3560 | | | | 3570 | | | |
| 3580 | | | | 3590 | | | |
| 3600 | | | | 3610 | | | |
| 3620 | | | | 3630 | | | |
| 3640 | | | | 3650 | | | |
| 3660 | | | | 3670 | | | |
| 3680 | | | | 3690 | | | |
| 3700 | | | | 3710 | | | |
| 3720 | | | | 3730 | | | |
| 3740 | | | | 3750 | | | |
| 3760 | | | | 3770 | | | |
| 3780 | | | | 3790 | | | |
| 3800 | | | | 3810 | | | |
| 3820 | | | | 3830 | | | |
| 3840 | | | | 3850 | | | |
| 3860 | | | | 3870 | | | |
| 3880 | | | | 3890 | | | |
| 3900 | | | | 3910 | | | |
| 3920 | | | | 3930 | | | |
| 3940 | | | | 3950 | | | |
| 3960 | | | | 3970 | | | |
| 3980 | | | | 3990 | | | |
| 4000 | | | | 4010 | | | |
| 4020 | | | | 4030 | | | |
| 4040 | | | | 4050 | | | |
| 4060 | | | | 4070 | | | |
| 4080 | | | | 4090 | | | |
| 4100 | | | | 4110 | | | |
| 4120 | | | | 4130 | | | |
| 4140 | | | | 4150 | | | |
| 4160 | | | | 4170 | | | |
| 4180 | | | | 4190 | | | |
| 4200 | | | | 4210 | | | |
| 4220 | | | | 4230 | | | |
| 4240 | | | | 4250 | | | |
| 4260 | | | | 4270 | | | |
| 4280 | | | | 4290 | | | |
| 4300 | | | | 4310 | | | |
| 4320 | | | | 4330 | | | |
| 4340 | | | | 4350 | | | |
| 4360 | | | | 4370 | | | |
| 4380 | | | | 4390 | | | |
| 4400 | | | | 4410 | | | |
| 4420 | | | | 4430 | | | |
| 4440 | | | | 4450 | | | |
| 4460 | | | | 4470 | | | |
| 4480 | | | | 4490 | | | |
| 4500 | | | | 4510 | | | |
| 4520 | | | | 4530 | | | |
| 4540 | | | | 4550 | | | |
| 4560 | | | | 4570 | | | |
| 4580 | | | | 4590 | | | |
| 4600 | | | | 4610 | | | |
| 4620 | | | | 4630 | | | |
| 4640 | | | | 4650 | | | |
| 4660 | | | | 4670 | | | |
| 4680 | | | | 4690 | | | |
| 4700 | | | | 4710 | | | |
| 4720 | | | | 4730 | | | |
| 4740 | | | | 4750 | | | |
| 4760 | | | | 4770 | | | |
| 4780 | | | | 4790 | | | |
| 4800 | | | | 4810 | | | |
| 4820 | | | | 4830 | | | |
| 4840 | | | | 4850 | | | |
| 4860 | | | | 4870 | | | |
| 4880 | | | | 4890 | | | |
| 4900 | | | | 4910 | | | |
| 4920 | | | | 4930 | | | |
| 4940 | | | | 4950 | | | |
| 4960 | | | | 4970 | | | |
| 4980 | | | | 4990 | | | |
| 5000 | | | | 5010 | | | |
| 5020 | | | | 5030 | | | |
| 5040 | | | | 5050 | | | |
| 5060 | | | | 5070 | | | |
| 5080 | | | | 5090 | | | |
| 5100 | | | | 5110 | | | |
| 5120 | | | | 5130 | | | |
| 5140 | | | | 5150 | | | |
| 5160 | | | | 5170 | | | |
| 5180 | | | | 5190 | | | |
| 5200 | | | | 5210 | | | |
| 5220 | | | | 5230 | | | |
| 5240 | | | | 5250 | | | |
| 5260 | | | | 5270 | | | |
| 5280 | | | | 5290 | | | |
| 5300 | | | | 5310 | | | |
| 5320 | | | | 5330 | | | |
| 5340 | | | | 5350 | | | |
| 5360 | | | | 5370 | | | |
| 5380 | | | | 5390 | | | |
| 5400 | | | | 5410 | | | |
| 5420 | | | | 5430 | | | |
| 5440 | | | | 5450 | | | |
| 5460 | | | | 5470 | | | |
| 5480 | | | | 5490 | | | |
| 5500 | | | | 5510 | | | |
| 5520 | | | | 5530 | | | |
| 5540 | | | | 5550 | | | |
| 5560 | | | | 5570 | | | |
| 5580 | | | | 5590 | | | |
| 5600 | | | | 5610 | | | |
| 5620 | | | | 5630 | | | |
| 5640 | | | | 5650 | | | |
| 5660 | | | | 5670 | | | |
| 5680 | | | | 5690 | | | |
| 5700 | | | | 5710 | | | |
| 5720 | | | | 5730 | | | |
| 5740 | | | | 5750 | | | |
| 5760 | | | | 5770 | | | |
| 5780 | | | | 5790 | | | |
| 5800 | | | | 5810 | | | |
| 5820 | | | | 5830 | | | |
| 5840 | | | | 5850 | | | |
| 5860 | | | | 5870 | | | |
| 5880 | | | | 5890 | | | |
| 5900 | | | | 5910 | | | |
| 5920 | | | | 5930 | | | |
| 5940 | | | | 5950 | | | |
| 5960 | | | | 5970 | | | |
| 5980 | | | | 5990 | | | |
| 6000 | | | | 6010 | | | |
| 6020 | | | | 6030 | | | |
| 6040 | | | | 6050 | | | |
| 6060 | | | | 6070 | | | |
| 6080 | | | | 6090 | | | |
| 6100 | | | | 6110 | | | |
| 6120 | | | | 6130 | | | |
| 6140 | | | | 6150 | | | |
| 6160 | | | | 6170 | | | |
| 6180 | | | | 6190 | | | |
| 6200 | | | | 6210 | | | |
| 6220 | | | | 6230 | | | |
| 6240 | | | | 6250 | | | |
| 6260 | | | | 6270 | | | |
| 6280 | | | | 6290 | | | |
| 6300 | | | | 6310 | | | |
| 6320 | | | | 6330 | | | |
| 6340 | | | | 6350 | | | |
| 6360 | | | | 6370 | | | |
| 6380 | | | | 6390 | | | |
| 6400 | | | | 6410 | | | |
| 6420 | | | | 6430 | | | |
| 6440 | | | | 6450 | | | |
| 6460 | | | | 6470 | | | |
| 6480 | | | | 6490 | | | |
| 6500 | | | | 6510 | | | |
| 6520 | | | | 6530 | | | |
| 6540 | | | | 6550 | | | |
| 6560 | | | | 6570 | | | |
| 6580 | | | | 6590 | | | |
| 6600 | | | | 6610 | | | |
| 6620 | | | | 6630 | | | |
| 6640 | | | | 6650 | | | |
| 6660 | | | | 6670 | | | |
| 6680 | | | | 6690 | | | |
| 6700 | | | | 6710 | | | |
| 6720 | | | | 6730 | | | |
| 6740 | | | | 6750 | | | |
| 6760 | | | | 6770 | | | |
| 6780 | | | | 6790 | | | |
| 6800 | | | | 6810 | | | |
| 6820 | | | | 6830 | | | |
| 6840 | | | | 6850 | | | |
| 6860 | | | | 6870 | | | |
| 6880 | | | | 6890 | | | |
| 6900 | | | | 6910 | | | |
| 6920 | | | | 6930 | | | |
| 6940 | | | | 6950 | | | |
| 6960 | | | | 6970 | | | |
| 6980 | | | | 6990 | | | |
| 7000 | | | | 7010 | | | |
| 7020 | | | | 7030 | | | |
| 7040 | | | | 7050 | | | |
| 7060 | | | | 7070 | | | |
| 7080 | | | | 7090 | | | |
| 7100 | | | | 7110 | | | |
| 7120 | | | | 7130 | | | |
| 7140 | | | | 7150 | | | |
| 7160 | | | | 7170 | | | |
| 7180 | | | | 7190 | | | |
| 7200 | | | | 7210 | | | |
| 7220 | | | | 7230 | | | |
| 7240 | | | | 7250 | | | |
| 7260 | | | | 7270 | | | |
| 7280 | | | | 7290 | | | |
| 7300 | | | | 7310 | | | |
| 7320 | | | | 7330 | | | |
| 7340 | | | | 7350 | | | |
| 7360 | | | | 7370 | | | |
| 7380 | | | | 7390 | | | |
| 7400 | | | | 7410 | | | |
| 7420 | | | | 7430 | | | |
| 7440 | | | | 7450 | | | |
| 7460 | | | | 7470 | | | |
| 7480 | | | | 7490 | | | |
| 7500 | | | | 7510 | | | |
| 7520 | | | | 7530 | | | |
| 7540 | | | | 7550 | | | |
| 7560 | | | | 7570 | | | |
| 7580 | | | | 7590 | | | |
| 7600 | | | | 7610 | | | |
| 7620 | | | | 7630 | | | |
| 7640 | | | | 7650 | | | |
| 7660 | | | | 7670 | | | |
| 7680 | | | | 7690 | | | |
| 7700 | | | | 7710 | | | |
| 7720 | | | | 7730 | | | |
| 7740 | | | | 7750 | | | |
| 7760 | | | | 7770 | | | |
| 7780 | | | | 7790 | | | |
| 7800 | | | | 7810 | | | |
| 7820 | | | | 7830 | | | |
| 7840 | | | | 7850 | | | |
| 7860 | | | | 7870 | | | |
| 7880 | | | | 7890 | | | |
| 7900 | | | | 7910 | | | |
| 7920 | | | | 7930 | | | |
| 7940 | | | | 7950 | | | |
| 7960 | | | | 7970 | | | |
| 7980 | | | | 7990 | | | |
| 8000 | | | | 8010 | | | |
| 8020 | | | | 8030 | | | |
| 8040 | | | | 8050 | | | |
| 8060 | | | | 8070 | | | |
| 8080 | | | | 8090 | | | |
| 8100 | | | | 8110 | | | |
| 8120 | | | | 8130 | | | |
| 8140 | | | | 8150 | | | |
| 8160 | | | | 8170 | | | |
| 8180 | | | | 8190 | | | |
| 8200 | | | | 8210 | | | |
| 8220 | | | | 8230 | | | |
| 8240 | | | | 8250 | | | |
| 8260 | | | | 8270 | | | |
| 8280 | | | | 8290 | | | |
| 8300 | | | | 8310 | | | |
| 8320 | | | | 8330 | | | |
| 8340 | | | | 8350 | | | |
| 8360 | | | | 8370 | | | |
| 8380 | | | | 8390 | | | |
| 8400 | | | | 8410 | | | |
| 8420 | | | | 8430 | | | |
| 8440 | | | | 8450 | | | |
| 8460 | | | | 8470 | | | |
| 8480 | | | | 8490 | | | |
| 8500 | | | | 8510 | | | |
| 8520 | | | | 8530 | | | |
| 8540 | | | | 8550 | | | |
| 8560 | | | | 8570 | | | |
| 8580 | | | | 8590 | | | |
| 8600 | | | | 8610 | | | |
| 8620 | | | | 8630 | | | |
| 8640 | | | | 8650 | | | |
| 8660 | | | | 8670 | | | |
| 8680 | | | | 8690 | | | |
| 8700 | | | | 8710 | | | |
| 8720 | | | | 8730 | | | |
| 8740 | | | | 8750 | | | |
| 8760 | | | | 8770 | | | |
| 8780 | | | | 8790 | | | |
| 8800 | | | | 8810 | | | |
| 8820 | | | | 8830 | | | |
| 8840 | | | | 8850 | | | |
| 8860 | | | | 8870 | | | |
| 8880 | | | | 8890 | | | |
| 8900 | | | | 8910 | | | |
| 8920 | | | | 8930 | | | |
| 8940 | | | | 8950 | | | |
| 8960 | | | | 8970 | | | |
| 8980 | | | | | | | |

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-9 DATE OF TEST July 28, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:34 p.m. END 3:46 p.m.AVERAGE MOISTURE CONTENT 21.1% AVERAGE SPECIFIC GRAVITY .504

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .2000 | .0000 | 22 000 | .2730 | .3990 | .1860 |
| 1 000 | .1002 | .2004 | .0003 | 23 000 | .2814 | .4100 | .1957 |
| 2 000 | .1006 | .2010 | .0008 | 24 000 | .2908 | .4210 | .2059 |
| 3 000 | .1010 | .2019 | .0014 | 25 000 | .3001 | .4330 | .2165 |
| 4 000 | .1026 | .2040 | .0033 | 26 000 | .3098 | .4445 | .2271 |
| 5 000 | .1458 | .2480 | .0469 | 27 000 | .3204 | .4525 | .2364 |
| 6 000 | .1573 | .2595 | .0584 | 28 000 | .3318 | .4700 | .2509 |
| 7 000 | .1629 | .2660 | .0644 | 29 000 | .3450 | .4850 | .2650 |
| 8 000 | .1696 | .2730 | .0713 | 30 000 | .3590 | .5000 | .2795 |
| 9 000 | .1749 | .2795 | .0772 | 31 000 | .3720 | .5160 | .2940 |
| 10 000 | .1810 | .2880 | .0845 | 32 000 | .3873 | .5320 | .3096 |
| 11 000 | .1877 | .2965 | .0921 | 33 000 | .4030 | .5510 | .3270 |
| 12 000 | .1961 | .3065 | .1013 | 34 000 | .4212 | .5700 | .3456 |
| 13 000 | .2050 | .3168 | .1109 | 35 000 | .4413 | .5915 | .3664 |
| 14 000 | .2129 | .3260 | .1194 | 36 000 | .4638 | .6150 | .3894 |
| 15 000 | .2210 | .3350 | .1280 | 37 000 | .4887 | .6410 | .4148 |
| 16 000 | .2275 | .3435 | .1355 | 38 000 | .5160 | .6710 | .4435 |
| 17 000 | .2342 | .3515 | .1428 | 39 000 | .5455 | .7020 | .4737 |
| 18 000 | .2418 | .3615 | .1516 | 40 000 | .5828 | .7410 | .5119 |
| 19 000 | .2497 | .3710 | .1603 | 41 000 | .6275 | .7870 | .5572 |
| 20 000 | .2575 | .3800 | .1687 | 41 650 | .7140 | .8750 | .6445 |
| 21 000 | .2651 | .3890 | .1770 | | | | |

REMARKS: No cracking noise, little dial jumping.
 Piece 2 failed on right bolt line.
 Piece 3 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-10 DATE OF TEST June 25, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:42 p.m. END 2:51 p.m.
 AVERAGE MOISTURE CONTENT 20.3% AVERAGE SPECIFIC GRAVITY .465

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 23 000 | .3491 | .2945 | .1718 |
| 1 000 | .2007 | .1001 | .0004 | 24 000 | .3594 | .3060 | .1827 |
| 2 000 | .2010 | .1015 | .0012 | 25 000 | .3703 | .3175 | .1939 |
| 3 000 | .2015 | .1045 | .0030 | 26 000 | .3823 | .3300 | .2061 |
| 4 000 | .2195 | .1250 | .0222 | 27 000 | .3970 | .3450 | .2210 |
| 5 000 | .2337 | .1420 | .0379 | 28 000 | .4122 | .3610 | .2366 |
| 6 000 | .2417 | .1540 | .0479 | 29 000 | .4298 | .3800 | .2549 |
| 7 000 | .2491 | .1650 | .0570 | 30 000 | .4491 | .4000 | .2746 |
| 8 000 | .2597 | .1795 | .0696 | 31 000 | .4700 | .4220 | .2960 |
| 9 000 | .2694 | .1945 | .0820 | 32 000 | .4935 | .4470 | .3202 |
| 10 000 | .2752 | .2040 | .0896 | 33 000 | .5193 | .4750 | .3471 |
| 11 000 | .2793 | .2110 | .0951 | 34 000 | .5490 | .5040 | .3765 |
| 12 000 | .2828 | .2170 | .0999 | 35 000 | .5803 | .5360 | .4081 |
| 13 000 | .2867 | .2235 | .1051 | 36 000 | .6132 | .5700 | .4416 |
| 14 000 | .2903 | .2290 | .1096 | 37 000 | .6530 | .6100 | .4815 |
| 15 000 | .2941 | .2335 | .1138 | 37 900 | .7980 | .7570 | .6275 |
| 16 000 | .2984 | .2385 | .1184 | | | | |
| 17 000 | .3032 | .2440 | .1236 | | | | |
| 18 000 | .3090 | .2505 | .1298 | | | | |
| 19 000 | .3152 | .2575 | .1363 | | | | |
| 20 000 | .3223 | .2660 | .1441 | | | | |
| 21 000 | .3303 | .2745 | .1524 | | | | |
| 22 000 | .3394 | .2840 | .1617 | | | | |

REMARKS: No cracking noise, slight dial jumping.
 Piece 1 failed by splitting to the right of the left bolt line.
 Piece 2 failed on both bolt lines.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-11 DATE OF TEST July 29th, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:05 p.m. END 3:18 p.m.
 AVERAGE MOISTURE CONTENT 22.8% AVERAGE SPECIFIC GRAVITY .462

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2728 | .2915 | .1821 |
| 1 000 | .1001 | .1002 | .0002 | 24 000 | .2851 | .3040 | .1945 |
| 2 000 | .1003 | .1009 | .0006 | 25 000 | .2976 | .3170 | .2073 |
| 3 000 | .1007 | .1018 | .0012 | 26 000 | .3110 | .3315 | .2212 |
| 4 000 | .1110 | .1180 | .0195 | 27 000 | .3263 | .3460 | .2361 |
| 5 000 | .1209 | .1315 | .0262 | 28 000 | .3427 | .3620 | .2523 |
| 6 000 | .1276 | .1400 | .0338 | 29 000 | .3600 | .3790 | .2695 |
| 7 000 | .1351 | .1470 | .0410 | 30 000 | .3790 | .3980 | .2885 |
| 8 000 | .1416 | .1550 | .0483 | 31 000 | .4002 | .4195 | .3098 |
| 9 000 | .1480 | .1620 | .0550 | 32 000 | .4197 | .4390 | .3293 |
| 10 000 | .1562 | .1710 | .0636 | 33 000 | .4450 | .4630 | .3540 |
| 11 000 | .1647 | .1800 | .0723 | 34 000 | .4720 | .4890 | .3805 |
| 12 000 | .1730 | .1895 | .0812 | 35 000 | .5010 | .5175 | .4092 |
| 13 000 | .1807 | .1975 | .0891 | 36 000 | .5315 | .5480 | .4397 |
| 14 000 | .1876 | .2050 | .0963 | 37 000 | .5654 | .5810 | .4732 |
| 15 000 | .1948 | .2125 | .1036 | 38 000 | .6050 | .6210 | .5130 |
| 16 000 | .2022 | .2210 | .1116 | 39 000 | .6445 | .6600 | .5522 |
| 17 000 | .2110 | .2300 | .1205 | 40 000 | .7038 | .7175 | .6106 |
| 18 000 | .2202 | .2400 | .1301 | 41 000 | .7730 | .7860 | .6795 |
| 19 000 | .2300 | .2500 | .1400 | 41 250 | .8200 | .8330 | .7265 |
| 20 000 | .2398 | .2590 | .1494 | | | | |
| 21 000 | .2497 | .2690 | .1593 | | | | |
| 22 000 | .2611 | .2800 | .1705 | | | | |

REMARKS: No cracking noise or dial jumping.
 Pieces 1 and 3 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-12 DATE OF TEST July 29, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:27 p.m. END 3:40 p.m.
 AVERAGE MOISTURE CONTENT 22.7% AVERAGE SPECIFIC GRAVITY .512

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .0000 | .0000 | 23 000 | .3167 | .1915 | .2041 |
| 1 000 | .1006 | .0002 | .0004 | 24 000 | .3270 | .2020 | .2145 |
| 2 000 | .1018 | .0005 | .0011 | 25 000 | .3390 | .2130 | .2260 |
| 3 000 | .1041 | .0008 | .0025 | 26 000 | .3510 | .2260 | .2385 |
| 4 000 | .1080 | .0010 | .0045 | 27 000 | .3635 | .2385 | .2510 |
| 5 000 | .1532 | .0350 | .0441 | 28 000 | .3750 | .2500 | .2625 |
| 6 000 | .1680 | .0470 | .0575 | 29 000 | .3900 | .2650 | .2775 |
| 7 000 | .1792 | .0570 | .0681 | 30 000 | .4048 | .2800 | .2924 |
| 8 000 | .1860 | .0675 | .0767 | 31 000 | .4193 | .2950 | .3071 |
| 9 000 | .1932 | .0705 | .0818 | 32 000 | .4357 | .3110 | .3233 |
| 10 000 | .2017 | .0780 | .0898 | 33 000 | .4538 | .3290 | .3414 |
| 11 000 | .2100 | .0860 | .0980 | 34 000 | .4727 | .3480 | .3603 |
| 12 000 | .2200 | .0955 | .1077 | 35 000 | .4930 | .3680 | .3805 |
| 13 000 | .2305 | .1060 | .1182 | 36 000 | .5145 | .3900 | .4022 |
| 14 000 | .2384 | .1140 | .1262 | 37 000 | .5410 | .4160 | .4285 |
| 15 000 | .2462 | .1220 | .1341 | 38 000 | .5700 | .4450 | .4575 |
| 16 000 | .2537 | .1295 | .1416 | 39 000 | .6035 | .4770 | .4902 |
| 17 000 | .2615 | .1375 | .1495 | 40 000 | .6388 | .5140 | .5264 |
| 18 000 | .2702 | .1455 | .1579 | 41 000 | .6840 | .5580 | .5710 |
| 19 000 | .2790 | .1550 | .1670 | 42 000 | .7395 | .6140 | .6267 |
| 20 000 | .2880 | .1640 | .1760 | 42 100 | .7752 | .6500 | .6626 |
| 21 000 | .2976 | .1730 | .1853 | | | | |
| 22 000 | .3063 | .1820 | .1941 | | | | |

REMARKS: Considerable cracking noise and jumping of dial.
 Piece 1 failed on both bolt lines.
 Piece 2 failed on right bolt line.
 Piece 3 failed on left bolt line.

TABLE I
Summary of the results of the
analysis of the data

| Group 1 | | | | Group 2 | | | |
|---------|------|------|------|---------|------|------|------|
| Mean | | | | Mean | | | |
| S.D. | | | | S.D. | | | |
| N | | | | N | | | |
| t | | | | t | | | |
| p | | | | p | | | |
| 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 | 0.40 |
| 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 |
| 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 | 1.50 |
| 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 |
| 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 |
| 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 | 1.80 |
| 1.90 | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 | 1.90 |
| 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 | 2.10 |
| 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 |
| 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 |
| 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 |
| 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 | 2.60 |
| 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 |
| 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 |
| 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 | 2.90 |
| 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 | 3.10 |
| 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 | 3.20 |
| 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 | 3.30 |
| 3.40 | 3.40 | 3.40 | 3.40 | 3.40 | 3.40 | 3.40 | 3.40 |
| 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 |
| 3.60 | 3.60 | 3.60 | 3.60 | 3.60 | 3.60 | 3.60 | 3.60 |
| 3.70 | 3.70 | 3.70 | 3.70 | 3.70 | 3.70 | 3.70 | 3.70 |
| 3.80 | 3.80 | 3.80 | 3.80 | 3.80 | 3.80 | 3.80 | 3.80 |
| 3.90 | 3.90 | 3.90 | 3.90 | 3.90 | 3.90 | 3.90 | 3.90 |
| 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 |
| 4.20 | 4.20 | 4.20 | 4.20 | 4.20 | 4.20 | 4.20 | 4.20 |
| 4.30 | 4.30 | 4.30 | 4.30 | 4.30 | 4.30 | 4.30 | 4.30 |
| 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 | 4.40 |
| 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 |
| 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 | 4.60 |
| 4.70 | 4.70 | 4.70 | 4.70 | 4.70 | 4.70 | 4.70 | 4.70 |
| 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 | 4.80 |
| 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |

TABLE I
Summary of the results of the
analysis of the data

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-13 DATE OF TEST July 29, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:47 p.m. END 3:55 p.m.
 AVERAGE MOISTURE CONTENT 21.9% AVERAGE SPECIFIC GRAVITY .448

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 23 000 | .1832 | .2950 | .1891 |
| 1 000 | .0000 | .1005 | .0002 | 24 000 | .1938 | .3065 | .2001 |
| 2 000 | .0002 | .1012 | .0007 | 25 000 | .2058 | .3190 | .2124 |
| 3 000 | .0005 | .1022 | .0014 | 26 000 | .2188 | .3330 | .2259 |
| 4 000 | .0234 | .1250 | .0242 | 27 000 | .2330 | .3470 | .2400 |
| 5 000 | .0362 | .1390 | .0376 | 28 000 | .2478 | .3620 | .2549 |
| 6 000 | .0441 | .1490 | .0465 | 29 000 | .2643 | .3780 | .2711 |
| 7 000 | .0547 | .1600 | .0573 | 30 000 | .2818 | .3965 | .2891 |
| 8 000 | .0618 | .1685 | .0651 | 31 000 | .2993 | .4150 | .3071 |
| 9 000 | .0690 | .1760 | .0725 | 32 000 | .3180 | .4345 | .3262 |
| 10 000 | .0760 | .1830 | .0795 | 33 000 | .3410 | .4570 | .3490 |
| 11 000 | .0827 | .1910 | .0868 | 34 000 | .3675 | .4840 | .3757 |
| 12 000 | .0888 | .1990 | .0939 | 35 000 | .3972 | .5150 | .4061 |
| 13 000 | .0952 | .2055 | .1003 | 36 000 | .4263 | .5450 | .4356 |
| 14 000 | .1014 | .2130 | .1072 | 37 000 | .4590 | .5770 | .4680 |
| 15 000 | .1081 | .2205 | .1143 | 38 000 | .4980 | .6180 | .5080 |
| 16 000 | .1158 | .2280 | .1219 | 38 650 | .5400 | .6600 | .5500 |
| 17 000 | .1244 | .2365 | .1304 | | | | |
| 18 000 | .1338 | .2460 | .1399 | | | | |
| 19 000 | .1432 | .2550 | .1491 | | | | |
| 20 000 | .1523 | .2645 | .1584 | | | | |
| 21 000 | .1623 | .2740 | .1681 | | | | |
| 22 000 | .1723 | .2840 | .1781 | | | | |

REMARKS: No cracking noise or dial jumping.
 Piece 1 failed on right bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on right bolt line.

Monthly Statement Showing the amount of interest received

| For the month of _____ 19__ | | | | For the month of _____ 19__ | | | |
|--|------|------|--------|--|------|------|--------|
| Name of the person or corporation to whom the interest is paid | | | | Name of the person or corporation to whom the interest is paid | | | |
| No. | Rate | Time | Amount | No. | Rate | Time | Amount |
| 1 | 100 | 100 | 100 | 1 | 100 | 100 | 100 |
| 2 | 100 | 100 | 100 | 2 | 100 | 100 | 100 |
| 3 | 100 | 100 | 100 | 3 | 100 | 100 | 100 |
| 4 | 100 | 100 | 100 | 4 | 100 | 100 | 100 |
| 5 | 100 | 100 | 100 | 5 | 100 | 100 | 100 |
| 6 | 100 | 100 | 100 | 6 | 100 | 100 | 100 |
| 7 | 100 | 100 | 100 | 7 | 100 | 100 | 100 |
| 8 | 100 | 100 | 100 | 8 | 100 | 100 | 100 |
| 9 | 100 | 100 | 100 | 9 | 100 | 100 | 100 |
| 10 | 100 | 100 | 100 | 10 | 100 | 100 | 100 |
| 11 | 100 | 100 | 100 | 11 | 100 | 100 | 100 |
| 12 | 100 | 100 | 100 | 12 | 100 | 100 | 100 |
| 13 | 100 | 100 | 100 | 13 | 100 | 100 | 100 |
| 14 | 100 | 100 | 100 | 14 | 100 | 100 | 100 |
| 15 | 100 | 100 | 100 | 15 | 100 | 100 | 100 |
| 16 | 100 | 100 | 100 | 16 | 100 | 100 | 100 |
| 17 | 100 | 100 | 100 | 17 | 100 | 100 | 100 |
| 18 | 100 | 100 | 100 | 18 | 100 | 100 | 100 |
| 19 | 100 | 100 | 100 | 19 | 100 | 100 | 100 |
| 20 | 100 | 100 | 100 | 20 | 100 | 100 | 100 |
| 21 | 100 | 100 | 100 | 21 | 100 | 100 | 100 |
| 22 | 100 | 100 | 100 | 22 | 100 | 100 | 100 |
| 23 | 100 | 100 | 100 | 23 | 100 | 100 | 100 |
| 24 | 100 | 100 | 100 | 24 | 100 | 100 | 100 |
| 25 | 100 | 100 | 100 | 25 | 100 | 100 | 100 |
| 26 | 100 | 100 | 100 | 26 | 100 | 100 | 100 |
| 27 | 100 | 100 | 100 | 27 | 100 | 100 | 100 |
| 28 | 100 | 100 | 100 | 28 | 100 | 100 | 100 |
| 29 | 100 | 100 | 100 | 29 | 100 | 100 | 100 |
| 30 | 100 | 100 | 100 | 30 | 100 | 100 | 100 |
| 31 | 100 | 100 | 100 | 31 | 100 | 100 | 100 |

Total interest received for the month of _____ 19__
 Total interest received for the month of _____ 19__
 Total interest received for the month of _____ 19__
 Total interest received for the month of _____ 19__

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-14 DATE OF TEST July 29, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 4:03 p.m. END 4:14 p.m.
 AVERAGE MOISTURE CONTENT 21.0% AVERAGE SPECIFIC GRAVITY .513

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .0000 | .0000 | 23 000 | .1734 | .1890 | .1812 |
| 1 000 | .0003 | .0002 | .0002 | 24 000 | .1819 | .1920 | .1869 |
| 2 000 | .0008 | .0006 | .0007 | 25 000 | .1918 | .2010 | .1964 |
| 3 000 | .0012 | .0010 | .0011 | 26 000 | .2025 | .2115 | .2070 |
| 4 000 | .0032 | .0038 | .0035 | 27 000 | .2140 | .2225 | .2182 |
| 5 000 | .0280 | .0310 | .0295 | 28 000 | .2261 | .2345 | .2303 |
| 6 000 | .0352 | .0385 | .0368 | 29 000 | .2385 | .2450 | .2418 |
| 7 000 | .0425 | .0460 | .0442 | 30 000 | .2520 | .2585 | .2552 |
| 8 000 | .0512 | .0560 | .0536 | 31 000 | .2665 | .2730 | .2697 |
| 9 000 | .0588 | .0635 | .0611 | 32 000 | .2816 | .2870 | .2843 |
| 10 000 | .0645 | .0700 | .0672 | 33 000 | .3010 | .3060 | .3035 |
| 11 000 | .0710 | .0780 | .0745 | 34 000 | .3223 | .3270 | .3246 |
| 12 000 | .0785 | .0860 | .0822 | 35 000 | .3465 | .3500 | .3482 |
| 13 000 | .0858 | .0945 | .0901 | 36 000 | .3728 | .3760 | .3744 |
| 14 000 | .0946 | .1040 | .0993 | 37 000 | .3995 | .4020 | .4007 |
| 15 000 | .1031 | .1140 | .1085 | 38 000 | .4255 | .4280 | .4267 |
| 16 000 | .1127 | .1245 | .1186 | 39 000 | .4640 | .4660 | .4650 |
| 17 000 | .1210 | .1335 | .1272 | 40 000 | .5335 | .5340 | .5337 |
| 18 000 | .1311 | .1430 | .1370 | | | | |
| 19 000 | .1397 | .1510 | .1453 | | | | |
| 20 000 | .1465 | .1580 | .1522 | | | | |
| 21 000 | .1550 | .1655 | .1602 | | | | |
| 22 000 | .1639 | .1745 | .1692 | | | | |

REMARKS: Some cracking noise; considerable dial jumping.
 Pieces 1 and 3 failed on right bolt line.
 Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: B-15 DATE OF TEST August 24, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 1:52 p.m. END 2:01 p.m.
 AVERAGE MOISTURE CONTENT 24.6% AVERAGE SPECIFIC GRAVITY 0.459

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2951 | .2915 | .1933 |
| 1 000 | .1001 | .1002 | .0001 | 24 000 | .3105 | .3075 | .2090 |
| 2 000 | .1002 | .1005 | .0003 | 25 000 | .3281 | .3265 | .2273 |
| 3 000 | .1003 | .1010 | .0006 | 26 000 | .3480 | .3475 | .2477 |
| 4 000 | .1004 | .1018 | .0011 | 27 000 | .3674 | .3665 | .2670 |
| 5 000 | .1006 | .1025 | .0015 | 28 000 | .3913 | .3915 | .2914 |
| 6 000 | .1110 | .1125 | .0117 | 29 000 | .4156 | .4165 | .3160 |
| 7 000 | .1227 | .1220 | .0223 | 30 000 | .4477 | .4500 | .3488 |
| 8 000 | .1348 | .1330 | .0339 | 31 000 | .4810 | .4840 | .3825 |
| 9 000 | .1440 | .1415 | .0427 | 32 000 | .5170 | .5200 | .4185 |
| 10 000 | .1510 | .1485 | .0497 | 33 000 | .5645 | .5685 | .4665 |
| 11 000 | .1598 | .1560 | .0579 | 34 000 | .6480 | .6540 | .5510 |
| 12 000 | .1690 | .1640 | .0665 | 34 150 | .6970 | .7000 | .5985 |
| 13 000 | .1780 | .1725 | .0752 | | | | |
| 14 000 | .1870 | .1810 | .0840 | | | | |
| 15 000 | .1957 | .1900 | .0928 | | | | |
| 16 000 | .2051 | .1990 | .1020 | | | | |
| 17 000 | .2140 | .2080 | .1110 | | | | |
| 18 000 | .2242 | .2185 | .1213 | | | | |
| 19 000 | .2356 | .2310 | .1333 | | | | |
| 20 000 | .2479 | .2445 | .1462 | | | | |
| 21 000 | .2630 | .2585 | .1607 | | | | |
| 22 000 | .2782 | .2740 | .1761 | | | | |

REMARKS: No cracking noise or dial jumping.
 Piece 1 failed on right bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on right bolt line.

Summary of the
 operations of the
 company for the year
 ending 31st March 1914

| Particulars | | | | Amount | | | |
|-----------------|------|----|----|--------|----|----|----|
| | | | | £ | | | |
| | | | | s | | | |
| | | | | d | | | |
| | | | | | | | |
| Balance forward | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Profit and loss | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Dividend | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Interest | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Depreciation | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Amortisation | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Reserve | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Provision | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Contingencies | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Other | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |
| Total | 1000 | 00 | 00 | 1000 | 00 | 00 | 00 |

Approved by the Board of Directors
 and the Shareholders of the
 company on 31st March 1914
 and the accounts for the year

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-1 DATE OF TEST Sept. 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:06 p.m. END 2:17 p.m.
 AVERAGE MOISTURE CONTENT 9.3% AVERAGE SPECIFIC GRAVITY .440

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .2000 | .0000 | 23 000 | .1683 | .2820 | .0751 |
| 1 000 | .1000 | .2002 | .0001 | 24 000 | .1712 | .2860 | .0786 |
| 2 000 | .1001 | .2005 | .0003 | 25 000 | .1753 | .2900 | .0826 |
| 3 000 | .1004 | .2009 | .0006 | 26 000 | .1800 | .2965 | .0882 |
| 4 000 | .1008 | .2015 | .0012 | 27 000 | .1848 | .3025 | .0936 |
| 5 000 | .1011 | .2022 | .0017 | 28 000 | .1902 | .3095 | .0998 |
| 6 000 | .1013 | .2045 | .0029 | 29 000 | .1964 | .3165 | .1064 |
| 7 000 | .1020 | .2068 | .0044 | 30 000 | .2021 | .3235 | .1128 |
| 8 000 | .1097 | .2135 | .0116 | 31 000 | .2081 | .3305 | .1193 |
| 9 000 | .1135 | .2175 | .0155 | 32 000 | .2146 | .3380 | .1263 |
| 10 000 | .1170 | .2208 | .0189 | 33 000 | .2215 | .3465 | .1340 |
| 11 000 | .1198 | .2245 | .0222 | 34 000 | .2303 | .3565 | .1434 |
| 12 000 | .1234 | .2285 | .0260 | 35 000 | .2384 | .3650 | .1517 |
| 13 000 | .1282 | .2340 | .0311 | 36 000 | .2474 | .3745 | .1610 |
| 14 000 | .1323 | .2385 | .0354 | 37 000 | .2586 | .3855 | .1720 |
| 15 000 | .1366 | .2435 | .0400 | 38 000 | .2692 | .3970 | .1831 |
| 16 000 | .1402 | .2480 | .0441 | 38 850 | .2812 | .4120 | .1966 |
| 17 000 | .1447 | .2530 | .0488 | 39 000 | .2870 | .4170 | .2020 |
| 18 000 | .1488 | .2585 | .0537 | 40 000 | .2980 | .4310 | .2145 |
| 19 000 | .1527 | .2635 | .0581 | 41 000 | .3124 | .4480 | .2302 |
| 20 000 | .1562 | .2675 | .0618 | 41 200 | .3180 | .4550 | .2365 |
| 21 000 | .1598 | .2720 | .0659 | 41 800 | .3610 | .5150 | .2880 |
| 22 000 | .1637 | .2765 | .0701 | | | | |

REMARKS: No cracking noise or dial jumping.
 Pieces 1 and 3 failed on right bolt line.
 Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-2 DATE OF TEST Sept. 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:29 p.m. END 2:40 p.m.
 AVERAGE MOISTURE CONTENT 9.4% AVERAGE SPECIFIC GRAVITY .454

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .2000 | .0000 | 21 000 | .3047 | .2550 | .0798 |
| 1 000 | .2005 | .2002 | .0003 | 22 000 | .3095 | .2595 | .0845 |
| 2 000 | .2009 | .2008 | .0008 | 23 000 | .3141 | .2640 | .0890 |
| 3 000 | .2012 | .2016 | .0014 | 24 000 | .3210 | .2700 | .0955 |
| 4 000 | .2019 | .2025 | .0022 | 25 000 | .3252 | .2740 | .0996 |
| 5 000 | .2024 | .2040 | .0032 | 26 000 | .3307 | .2780 | .1043 |
| 6 000 | .2082 | .2090 | .0086 | 27 000 | .3363 | .2835 | .1099 |
| 7 000 | .2158 | .2130 | .0144 | 28 000 | .3430 | .2895 | .1162 |
| 8 000 | .2230 | .2170 | .0200 | 29 000 | .3497 | .2955 | .1226 |
| 9 000 | .2298 | .2195 | .0247 | 30 000 | .3560 | .3015 | .1287 |
| 10 000 | .2362 | .2220 | .0291 | 31 000 | .3634 | .3075 | .1354 |
| 11 000 | .2432 | .2250 | .0341 | 32 000 | .3710 | .3145 | .1427 |
| 12 000 | .2508 | .2270 | .0389 | 33 000 | .3792 | .3225 | .1508 |
| 13 000 | .2580 | .2300 | .0440 | 34 000 | .3880 | .3300 | .1590 |
| 14 000 | .2648 | .2315 | .0481 | 35 000 | .3970 | .3390 | .1680 |
| 15 000 | .2720 | .2350 | .0535 | 36 000 | .4072 | .3470 | .1771 |
| 16 000 | .2778 | .2375 | .0576 | 37 000 | .4190 | .3590 | .1890 |
| 17 000 | .2840 | .2405 | .0622 | 38 000 | .4335 | .3720 | .2028 |
| 18 000 | .2900 | .2440 | .0670 | | | | |
| 19 000 | .2948 | .2475 | .0711 | To be continued on next page. | | | |
| 20 000 | .3000 | .2515 | .0757 | | | | |

STATE OF NEW YORK
IN SENATE,
January 10, 1894.

REPORT OF THE
COMMISSIONERS OF THE LAND OFFICE,
IN ANSWER TO A RESOLUTION PASSED BY THE SENATE,
MAY 1, 1893.

| Year. | Acres. | Value. | Year. | Acres. | Value. | Year. | Acres. |
|-------|--------|----------|-------|--------|----------|-------|--------|
| 1890. | 1,000. | 100,000. | 1891. | 1,000. | 100,000. | 1892. | 1,000. |
| 1893. | 1,000. | 100,000. | 1894. | 1,000. | 100,000. | 1895. | 1,000. |
| 1896. | 1,000. | 100,000. | 1897. | 1,000. | 100,000. | 1898. | 1,000. |
| 1899. | 1,000. | 100,000. | 1900. | 1,000. | 100,000. | 1901. | 1,000. |
| 1902. | 1,000. | 100,000. | 1903. | 1,000. | 100,000. | 1904. | 1,000. |
| 1905. | 1,000. | 100,000. | 1906. | 1,000. | 100,000. | 1907. | 1,000. |
| 1908. | 1,000. | 100,000. | 1909. | 1,000. | 100,000. | 1910. | 1,000. |
| 1911. | 1,000. | 100,000. | 1912. | 1,000. | 100,000. | 1913. | 1,000. |
| 1914. | 1,000. | 100,000. | 1915. | 1,000. | 100,000. | 1916. | 1,000. |
| 1917. | 1,000. | 100,000. | 1918. | 1,000. | 100,000. | 1919. | 1,000. |
| 1920. | 1,000. | 100,000. | 1921. | 1,000. | 100,000. | 1922. | 1,000. |
| 1923. | 1,000. | 100,000. | 1924. | 1,000. | 100,000. | 1925. | 1,000. |
| 1926. | 1,000. | 100,000. | 1927. | 1,000. | 100,000. | 1928. | 1,000. |
| 1929. | 1,000. | 100,000. | 1930. | 1,000. | 100,000. | 1931. | 1,000. |
| 1932. | 1,000. | 100,000. | 1933. | 1,000. | 100,000. | 1934. | 1,000. |
| 1935. | 1,000. | 100,000. | 1936. | 1,000. | 100,000. | 1937. | 1,000. |
| 1938. | 1,000. | 100,000. | 1939. | 1,000. | 100,000. | 1940. | 1,000. |
| 1941. | 1,000. | 100,000. | 1942. | 1,000. | 100,000. | 1943. | 1,000. |
| 1944. | 1,000. | 100,000. | 1945. | 1,000. | 100,000. | 1946. | 1,000. |
| 1947. | 1,000. | 100,000. | 1948. | 1,000. | 100,000. | 1949. | 1,000. |
| 1950. | 1,000. | 100,000. | 1951. | 1,000. | 100,000. | 1952. | 1,000. |
| 1953. | 1,000. | 100,000. | 1954. | 1,000. | 100,000. | 1955. | 1,000. |
| 1956. | 1,000. | 100,000. | 1957. | 1,000. | 100,000. | 1958. | 1,000. |
| 1959. | 1,000. | 100,000. | 1960. | 1,000. | 100,000. | 1961. | 1,000. |
| 1962. | 1,000. | 100,000. | 1963. | 1,000. | 100,000. | 1964. | 1,000. |
| 1965. | 1,000. | 100,000. | 1966. | 1,000. | 100,000. | 1967. | 1,000. |
| 1968. | 1,000. | 100,000. | 1969. | 1,000. | 100,000. | 1970. | 1,000. |
| 1971. | 1,000. | 100,000. | 1972. | 1,000. | 100,000. | 1973. | 1,000. |
| 1974. | 1,000. | 100,000. | 1975. | 1,000. | 100,000. | 1976. | 1,000. |
| 1977. | 1,000. | 100,000. | 1978. | 1,000. | 100,000. | 1979. | 1,000. |
| 1980. | 1,000. | 100,000. | 1981. | 1,000. | 100,000. | 1982. | 1,000. |
| 1983. | 1,000. | 100,000. | 1984. | 1,000. | 100,000. | 1985. | 1,000. |
| 1986. | 1,000. | 100,000. | 1987. | 1,000. | 100,000. | 1988. | 1,000. |
| 1989. | 1,000. | 100,000. | 1990. | 1,000. | 100,000. | 1991. | 1,000. |
| 1992. | 1,000. | 100,000. | 1993. | 1,000. | 100,000. | 1994. | 1,000. |
| 1995. | 1,000. | 100,000. | 1996. | 1,000. | 100,000. | 1997. | 1,000. |
| 1998. | 1,000. | 100,000. | 1999. | 1,000. | 100,000. | 2000. | 1,000. |
| 2001. | 1,000. | 100,000. | 2002. | 1,000. | 100,000. | 2003. | 1,000. |
| 2004. | 1,000. | 100,000. | 2005. | 1,000. | 100,000. | 2006. | 1,000. |
| 2007. | 1,000. | 100,000. | 2008. | 1,000. | 100,000. | 2009. | 1,000. |
| 2010. | 1,000. | 100,000. | 2011. | 1,000. | 100,000. | 2012. | 1,000. |
| 2013. | 1,000. | 100,000. | 2014. | 1,000. | 100,000. | 2015. | 1,000. |
| 2016. | 1,000. | 100,000. | 2017. | 1,000. | 100,000. | 2018. | 1,000. |
| 2019. | 1,000. | 100,000. | 2020. | 1,000. | 100,000. | 2021. | 1,000. |
| 2022. | 1,000. | 100,000. | 2023. | 1,000. | 100,000. | 2024. | 1,000. |
| 2025. | 1,000. | 100,000. | 2026. | 1,000. | 100,000. | 2027. | 1,000. |
| 2028. | 1,000. | 100,000. | 2029. | 1,000. | 100,000. | 2030. | 1,000. |
| 2031. | 1,000. | 100,000. | 2032. | 1,000. | 100,000. | 2033. | 1,000. |
| 2034. | 1,000. | 100,000. | 2035. | 1,000. | 100,000. | 2036. | 1,000. |
| 2037. | 1,000. | 100,000. | 2038. | 1,000. | 100,000. | 2039. | 1,000. |
| 2040. | 1,000. | 100,000. | 2041. | 1,000. | 100,000. | 2042. | 1,000. |
| 2043. | 1,000. | 100,000. | 2044. | 1,000. | 100,000. | 2045. | 1,000. |
| 2046. | 1,000. | 100,000. | 2047. | 1,000. | 100,000. | 2048. | 1,000. |
| 2049. | 1,000. | 100,000. | 2050. | 1,000. | 100,000. | 2051. | 1,000. |
| 2052. | 1,000. | 100,000. | 2053. | 1,000. | 100,000. | 2054. | 1,000. |
| 2055. | 1,000. | 100,000. | 2056. | 1,000. | 100,000. | 2057. | 1,000. |
| 2058. | 1,000. | 100,000. | 2059. | 1,000. | 100,000. | 2060. | 1,000. |
| 2061. | 1,000. | 100,000. | 2062. | 1,000. | 100,000. | 2063. | 1,000. |
| 2064. | 1,000. | 100,000. | 2065. | 1,000. | 100,000. | 2066. | 1,000. |
| 2067. | 1,000. | 100,000. | 2068. | 1,000. | 100,000. | 2069. | 1,000. |
| 2070. | 1,000. | 100,000. | 2071. | 1,000. | 100,000. | 2072. | 1,000. |
| 2073. | 1,000. | 100,000. | 2074. | 1,000. | 100,000. | 2075. | 1,000. |
| 2076. | 1,000. | 100,000. | 2077. | 1,000. | 100,000. | 2078. | 1,000. |
| 2079. | 1,000. | 100,000. | 2080. | 1,000. | 100,000. | 2081. | 1,000. |
| 2082. | 1,000. | 100,000. | 2083. | 1,000. | 100,000. | 2084. | 1,000. |
| 2085. | 1,000. | 100,000. | 2086. | 1,000. | 100,000. | 2087. | 1,000. |
| 2088. | 1,000. | 100,000. | 2089. | 1,000. | 100,000. | 2090. | 1,000. |
| 2091. | 1,000. | 100,000. | 2092. | 1,000. | 100,000. | 2093. | 1,000. |
| 2094. | 1,000. | 100,000. | 2095. | 1,000. | 100,000. | 2096. | 1,000. |
| 2097. | 1,000. | 100,000. | 2098. | 1,000. | 100,000. | 2099. | 1,000. |
| 2100. | 1,000. | 100,000. | 2101. | 1,000. | 100,000. | 2102. | 1,000. |
| 2103. | 1,000. | 100,000. | 2104. | 1,000. | 100,000. | 2105. | 1,000. |
| 2106. | 1,000. | 100,000. | 2107. | 1,000. | 100,000. | 2108. | 1,000. |
| 2109. | 1,000. | 100,000. | 2110. | 1,000. | 100,000. | 2111. | 1,000. |
| 2112. | 1,000. | 100,000. | 2113. | 1,000. | 100,000. | 2114. | 1,000. |
| 2115. | 1,000. | 100,000. | 2116. | 1,000. | 100,000. | 2117. | 1,000. |
| 2118. | 1,000. | 100,000. | 2119. | 1,000. | 100,000. | 2120. | 1,000. |
| 2121. | 1,000. | 100,000. | 2122. | 1,000. | 100,000. | 2123. | 1,000. |
| 2124. | 1,000. | 100,000. | 2125. | 1,000. | 100,000. | 2126. | 1,000. |
| 2127. | 1,000. | 100,000. | 2128. | 1,000. | 100,000. | 2129. | 1,000. |
| 2130. | 1,000. | 100,000. | 2131. | 1,000. | 100,000. | 2132. | 1,000. |
| 2133. | 1,000. | 100,000. | 2134. | 1,000. | 100,000. | 2135. | 1,000. |
| 2136. | 1,000. | 100,000. | 2137. | 1,000. | 100,000. | 2138. | 1,000. |
| 2139. | 1,000. | 100,000. | 2140. | 1,000. | 100,000. | 2141. | 1,000. |
| 2142. | 1,000. | 100,000. | 2143. | 1,000. | 100,000. | 2144. | 1,000. |
| 2145. | 1,000. | 100,000. | 2146. | 1,000. | 100,000. | 2147. | 1,000. |
| 2148. | 1,000. | 100,000. | 2149. | 1,000. | 100,000. | 2150. | 1,000. |
| 2151. | 1,000. | 100,000. | 2152. | 1,000. | 100,000. | 2153. | 1,000. |
| 2154. | 1,000. | 100,000. | 2155. | 1,000. | 100,000. | 2156. | 1,000. |
| 2157. | 1,000. | 100,000. | 2158. | 1,000. | 100,000. | 2159. | 1,000. |
| 2160. | 1,000. | 100,000. | 2161. | 1,000. | 100,000. | 2162. | 1,000. |
| 2163. | 1,000. | 100,000. | 2164. | 1,000. | 100,000. | 2165. | 1,000. |
| 2166. | 1,000. | 100,000. | 2167. | 1,000. | 100,000. | 2168. | 1,000. |
| 2169. | 1,000. | 100,000. | 2170. | 1,000. | 100,000. | 2171. | 1,000. |
| 2172. | 1,000. | 100,000. | 2173. | 1,000. | 100,000. | 2174. | 1,000. |
| 2175. | 1,000. | 100,000. | 2176. | 1,000. | 100,000. | 2177. | 1,000. |
| 2178. | 1,000. | 100,000. | 2179. | 1,000. | 100,000. | 2180. | 1,000. |
| 2181. | 1,000. | 100,000. | 2182. | 1,000. | 100,000. | 2183. | 1,000. |
| 2184. | 1,000. | 100,000. | 2185. | 1,000. | 100,000. | 2186. | 1,000. |
| 2187. | 1,000. | 100,000. | 2188. | 1,000. | 100,000. | 2189. | 1,000. |
| 2190. | 1,000. | 100,000. | 2191. | 1,000. | 100,000. | 2192. | 1,000. |
| 2193. | 1,000. | 100,000. | 2194. | 1,000. | 100,000. | 2195. | 1,000. |
| 2196. | 1,000. | 100,000. | 2197. | 1,000. | 100,000. | 2198. | 1,000. |
| 2199. | 1,000. | 100,000. | 2200. | 1,000. | 100,000. | 2201. | 1,000. |
| 2202. | 1,000. | 100,000. | 2203. | 1,000. | 100,000. | 2204. | 1,000. |
| 2205. | 1,000. | 100,000. | 2206. | 1,000. | 100,000. | 2207. | 1,000. |
| 2208. | 1,000. | 100,000. | 2209. | 1,000. | 100,000. | 2210. | 1,000. |
| 2211. | 1,000. | 100,000. | 2212. | 1,000. | 100,000. | 2213. | 1,000. |
| 2214. | 1,000. | 100,000. | 2215. | 1,000. | 100,000. | 2216. | 1,000. |
| 2217. | 1,000. | 100,000. | 2218. | 1,000. | 100,000. | 2219. | 1,000. |
| 2220. | 1,000. | 100,000. | 2221. | 1,000. | 100,000. | 2222. | 1,000. |
| 2223. | 1,000. | 100,000. | 2224. | 1,000. | 100,000. | 2225. | 1,000. |
| 2226. | 1,000. | 100,000. | 2227. | 1,000. | 100,000. | 2228. | 1,000. |
| 2229. | 1,000. | 100,000. | 2230. | 1,000. | 100,000. | 2231. | 1,000. |
| 2232. | 1,000. | 100,000. | 2233. | 1,000. | 100,000. | 2234. | 1,000. |
| 2235. | 1,000. | 100,000. | 2236. | 1,000. | 100,000. | 2237. | 1,000. |
| 2238. | 1,000. | 100,000. | 2239. | 1,000. | 100,000. | 2240. | 1,000. |
| 2241. | 1,000. | 100,000. | 2242. | 1,000. | 100,000. | 2243. | 1,000. |
| 2244. | 1,000. | 100,000. | 2245. | 1,000. | 100,000. | 2246. | 1,000. |
| 2247. | 1,000. | 100,000. | 2248. | 1,000. | 100,000. | 2249. | 1,000. |
| 2250. | 1,000. | 100,000. | 2251. | 1,000. | 100,000. | 2252. | 1,000. |
| 2253. | 1,000. | 100,000. | 2254. | 1,000. | 100,000. | 2255. | 1,000. |
| 2256. | 1,000. | 100,000. | 2257. | 1,000. | 100,000. | 2258. | 1,000. |
| 2259. | 1,000. | 100,000. | 2260. | 1,000. | 100,000. | 2261. | 1,000. |
| 2262. | 1,000. | 100,000. | 2263. | 1,000. | 100,000. | 2264. | 1,000. |
| 2265. | 1,000. | 100,000. | 2266. | 1,000. | 100,000. | 2267. | 1,000. |
| 2268. | 1,000. | 100,000. | 2269. | 1,000. | 100,000. | 2270. | 1,000. |
| 2271. | 1,000. | 100,000. | 2272. | 1,000. | 100,000. | 2273. | 1,000. |
| 2274. | 1,000. | 100,000. | 2275. | 1,000. | 100,000. | 2276. | 1,000. |
| 2277. | 1,000. | 100,000. | 2278. | 1,000. | 100,000. | 2279. | 1,000. |
| 2280. | 1,000. | 100,000. | 2281. | 1,000. | 100,000. | 2282. | 1,000. |
| 2283. | 1,000. | 100,000. | 2284. | 1,000. | 100,000. | 2285. | 1,000. |
| 2286. | 1,000. | 100,000. | 2287. | 1,000. | 100,000. | 2288. | 1,000. |
| 2289. | 1,000. | 100,000. | 2290. | 1,000. | 100,000. | 2291. | 1,000. |
| 2292. | 1,000. | 100,000. | 2293. | 1,000. | 100,000. | 2294. | 1,000. |
| 2295. | 1,000. | 100,000. | 2296. | 1,000. | 100,000. | 2297. | 1,000. |
| 2298. | 1,000. | 100,000. | 2299. | 1,000. | 100,000. | 2300. | 1,000. |
| 2301. | 1,000. | 100,000. | 2302. | 1,000. | 100,000. | 2303. | 1,000. |
| 2304. | 1,000. | 100,000. | 2305. | 1,000. | 100,000. | 2306. | 1,000. |
| 2307. | 1,000. | 100,0 | | | | | |

JOINT NO: C-2 DATE OF TEST Sept. 14, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 39 000 | .4445 | .3820 | .2132 | | | | |
| 40 000 | .4562 | .3930 | .2246 | | | | |
| 41 000 | .4713 | .4070 | .2391 | | | | |
| 42 000 | .4875 | .4220 | .2547 | | | | |
| 43 000 | .5040 | .4390 | .2715 | | | | |
| 44 000 | .5195 | .4540 | .2867 | | | | |
| 45 000 | .5400 | .4735 | .3067 | | | | |
| 46 000 | .5630 | .4950 | .3290 | | | | |
| 47 050 | .5868 | .5180 | .3524 | | | | |

REMARKS: No dial jumping or cracking noise.
Pieces 1 and 3 failed on left bolt line.
Piece 2 failed on right bolt line.

| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
|-------|-------|-------|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ | _____ | _____ | _____ |

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-3 DATE OF TEST Sept. 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 2:48 p.m. END 3:00 p.m.
 AVERAGE MOISTURE CONTENT 9.5% AVERAGE SPECIFIC GRAVITY .466

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 22 000 | .2784 | .1740 | .0762 |
| 1 000 | .2002 | .1001 | .0001 | 23 000 | .2805 | .1765 | .0785 |
| 2 000 | .2004 | .1004 | .0004 | 24 000 | .2832 | .1795 | .0813 |
| 3 000 | .2010 | .1009 | .0010 | 25 000 | .2860 | .1825 | .0842 |
| 4 000 | .2017 | .1012 | .0015 | 26 000 | .2888 | .1855 | .0871 |
| 5 000 | .2021 | .1035 | .0028 | 27 000 | .2918 | .1890 | .0904 |
| 6 000 | .2030 | .1070 | .0050 | 28 000 | .2958 | .1935 | .0947 |
| 7 000 | .2052 | .1115 | .0083 | 29 000 | .3000 | .1980 | .0990 |
| 8 000 | .2138 | .1175 | .0156 | 30 000 | .3046 | .2025 | .1035 |
| 9 000 | .2208 | .1215 | .0212 | 31 000 | .3096 | .2085 | .1090 |
| 10 000 | .2267 | .1250 | .0259 | 32 000 | .3149 | .2135 | .1142 |
| 11 000 | .2328 | .1310 | .0319 | 33 000 | .3207 | .2200 | .1203 |
| 12 000 | .2380 | .1360 | .0370 | 34 000 | .3276 | .2265 | .1270 |
| 13 000 | .2428 | .1405 | .0417 | 35 000 | .3337 | .2325 | .1331 |
| 14 000 | .2502 | .1470 | .0486 | 36 000 | .3413 | .2400 | .1406 |
| 15 000 | .2580 | .1540 | .0560 | 37 000 | .3492 | .2480 | .1486 |
| 16 000 | .2620 | .1580 | .0600 | 38 000 | .3588 | .2580 | .1584 |
| 17 000 | .2651 | .1605 | .0628 | 39 000 | .3697 | .2670 | .1684 |
| 18 000 | .2682 | .1635 | .0659 | 40 000 | .3800 | .2785 | .1792 |
| 19 000 | .2710 | .1665 | .0688 | To be continued on next page. | | | |
| 20 000 | .2738 | .1690 | .0714 | | | | |
| 21 000 | .2760 | .1715 | .0738 | | | | |

TABLE III Summary of the results of the analysis of variance

| Source of variation | | | | Degrees of freedom | | | |
|---------------------|-----|-----|-----|--------------------|-----|-----|-----|
| Between groups | | | | Within groups | | | |
| Total | | | | Error | | | |
| Sum of squares | | | | Mean square | | | |
| F | | | | t | | | |
| p | | | | p | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| 22 | 22 | 22 | 22 | 22 | 22 | 22 | 22 |
| 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 |
| 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| 38 | 38 | 38 | 38 | 38 | 38 | 38 | 38 |
| 39 | 39 | 39 | 39 | 39 | 39 | 39 | 39 |
| 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| 41 | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
| 43 | 43 | 43 | 43 | 43 | 43 | 43 | 43 |
| 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 |
| 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 |
| 47 | 47 | 47 | 47 | 47 | 47 | 47 | 47 |
| 48 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| 49 | 49 | 49 | 49 | 49 | 49 | 49 | 49 |
| 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 |
| 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 |
| 57 | 57 | 57 | 57 | 57 | 57 | 57 | 57 |
| 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 |
| 59 | 59 | 59 | 59 | 59 | 59 | 59 | 59 |
| 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 |
| 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 |
| 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 |
| 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| 66 | 66 | 66 | 66 | 66 | 66 | 66 | 66 |
| 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |
| 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |
| 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 |
| 72 | 72 | 72 | 72 | 72 | 72 | 72 | 72 |
| 73 | 73 | 73 | 73 | 73 | 73 | 73 | 73 |
| 74 | 74 | 74 | 74 | 74 | 74 | 74 | 74 |
| 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| 78 | 78 | 78 | 78 | 78 | 78 | 78 | 78 |
| 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 |
| 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 |
| 82 | 82 | 82 | 82 | 82 | 82 | 82 | 82 |
| 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 |
| 84 | 84 | 84 | 84 | 84 | 84 | 84 | 84 |
| 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| 86 | 86 | 86 | 86 | 86 | 86 | 86 | 86 |
| 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 |
| 88 | 88 | 88 | 88 | 88 | 88 | 88 | 88 |
| 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 |
| 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| 93 | 93 | 93 | 93 | 93 | 93 | 93 | 93 |
| 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 |
| 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| 97 | 97 | 97 | 97 | 97 | 97 | 97 | 97 |
| 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 |
| 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

JOINT NO: C-3 DATE OF TEST Sept. 14, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .3920 | .2910 | .1915 | | | | |
| 42 000 | .4048 | .3040 | .2044 | | | | |
| 43 000 | .4202 | .3195 | .2198 | | | | |
| 44 000 | .4360 | .3350 | .2355 | | | | |
| 45 000 | .4525 | .3520 | .2522 | | | | |
| 46 000 | .4742 | .3735 | .2738 | | | | |
| 47 000 | .4948 | .3950 | .2949 | | | | |
| 48 000 | .5180 | .4190 | .3185 | | | | |
| 49 000 | .5480 | .4500 | .3490 | | | | |
| 50 000 | .5780 | .4800 | .3790 | | | | |
| 52 000 | .6450 | .5500 | .4475 | | | | |

REMARKS; No dial jumping or cracking noise.
Pieces 1 and 3 failed on both bolt lines.
Piece 2 failed on right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-4 DATE OF TEST Sept. 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:11 p.m. END 3:22 p.m.
 AVERAGE MOISTURE CONTENT 9.8% AVERAGE SPECIFIC GRAVITY .474

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .3000 | .2000 | .0000 | 24 000 | .3930 | .2975 | .0952 |
| 1 000 | .3000 | .2002 | .0001 | 25 000 | .3984 | .3050 | .1017 |
| 2 000 | .3001 | .2004 | .0002 | 26 000 | .4052 | .3130 | .1091 |
| 3 000 | .3003 | .2008 | .0005 | 27 000 | .4110 | .3195 | .1152 |
| 4 000 | .3004 | .2022 | .0013 | 28 000 | .4170 | .3215 | .1192 |
| 5 000 | .3021 | .2045 | .0033 | 29 000 | .4237 | .3335 | .1286 |
| 6 000 | .3094 | .2090 | .0092 | 30 000 | .4300 | .3405 | .1357 |
| 7 000 | .3192 | .2165 | .0178 | 31 000 | .4372 | .3480 | .1426 |
| 8 000 | .3262 | .2220 | .0241 | 32 000 | .4447 | .3550 | .1498 |
| 9 000 | .3312 | .2265 | .0288 | 33 000 | .4526 | .3635 | .1575 |
| 10 000 | .3367 | .2310 | .0339 | 34 000 | .4615 | .3720 | .1667 |
| 11 000 | .3411 | .2350 | .0380 | 35 000 | .4702 | .3805 | .1753 |
| 12 000 | .3450 | .2395 | .0423 | 36 000 | .4796 | .3890 | .1843 |
| 13 000 | .3490 | .2435 | .0462 | 37 000 | .4907 | .4000 | .1953 |
| 14 000 | .3525 | .2470 | .0498 | 38 000 | .5030 | .4130 | .2080 |
| 15 000 | .3558 | .2505 | .0532 | 39 000 | .5182 | .4300 | .2241 |
| 16 000 | .3601 | .2561 | .0580 | 40 000 | .5330 | .4460 | .2395 |
| 17 000 | .3641 | .2605 | .0623 | 41 000 | .5483 | .4630 | .2556 |
| 18 000 | .3680 | .2650 | .0665 | 42 000 | .5660 | .4810 | .2735 |
| 19 000 | .3720 | .2695 | .0708 | 43 000 | .5862 | .5010 | .2936 |
| 20 000 | .3784 | .2785 | .0784 | 43 200 | .5920 | .5100 | .3010 |
| 21 000 | .3812 | .2820 | .0816 | 44 000 | .6530 | .5690 | .3610 |
| 22 000 | .3847 | .2865 | .0856 | 45 000 | .6870 | .6000 | .3935 |
| 23 000 | .3885 | .2915 | .0900 | | | | |

REMARKS; No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on right bolt line.

RECORD OF THE PROCEEDINGS OF THE SENATE OF THE DISTRICT OF COLUMBIA FOR THE YEAR 1901

| JANUARY | | | | FEBRUARY | | | |
|---------|-------|--------|--------|----------|-------|--------|--------|
| DATE | HOUSE | SENATE | REPORT | DATE | HOUSE | SENATE | REPORT |
| Jan. 1 | 100 | 100 | 100 | Feb. 1 | 100 | 100 | 100 |
| Jan. 2 | 100 | 100 | 100 | Feb. 2 | 100 | 100 | 100 |
| Jan. 3 | 100 | 100 | 100 | Feb. 3 | 100 | 100 | 100 |
| Jan. 4 | 100 | 100 | 100 | Feb. 4 | 100 | 100 | 100 |
| Jan. 5 | 100 | 100 | 100 | Feb. 5 | 100 | 100 | 100 |
| Jan. 6 | 100 | 100 | 100 | Feb. 6 | 100 | 100 | 100 |
| Jan. 7 | 100 | 100 | 100 | Feb. 7 | 100 | 100 | 100 |
| Jan. 8 | 100 | 100 | 100 | Feb. 8 | 100 | 100 | 100 |
| Jan. 9 | 100 | 100 | 100 | Feb. 9 | 100 | 100 | 100 |
| Jan. 10 | 100 | 100 | 100 | Feb. 10 | 100 | 100 | 100 |
| Jan. 11 | 100 | 100 | 100 | Feb. 11 | 100 | 100 | 100 |
| Jan. 12 | 100 | 100 | 100 | Feb. 12 | 100 | 100 | 100 |
| Jan. 13 | 100 | 100 | 100 | Feb. 13 | 100 | 100 | 100 |
| Jan. 14 | 100 | 100 | 100 | Feb. 14 | 100 | 100 | 100 |
| Jan. 15 | 100 | 100 | 100 | Feb. 15 | 100 | 100 | 100 |
| Jan. 16 | 100 | 100 | 100 | Feb. 16 | 100 | 100 | 100 |
| Jan. 17 | 100 | 100 | 100 | Feb. 17 | 100 | 100 | 100 |
| Jan. 18 | 100 | 100 | 100 | Feb. 18 | 100 | 100 | 100 |
| Jan. 19 | 100 | 100 | 100 | Feb. 19 | 100 | 100 | 100 |
| Jan. 20 | 100 | 100 | 100 | Feb. 20 | 100 | 100 | 100 |
| Jan. 21 | 100 | 100 | 100 | Feb. 21 | 100 | 100 | 100 |
| Jan. 22 | 100 | 100 | 100 | Feb. 22 | 100 | 100 | 100 |
| Jan. 23 | 100 | 100 | 100 | Feb. 23 | 100 | 100 | 100 |
| Jan. 24 | 100 | 100 | 100 | Feb. 24 | 100 | 100 | 100 |
| Jan. 25 | 100 | 100 | 100 | Feb. 25 | 100 | 100 | 100 |
| Jan. 26 | 100 | 100 | 100 | Feb. 26 | 100 | 100 | 100 |
| Jan. 27 | 100 | 100 | 100 | Feb. 27 | 100 | 100 | 100 |
| Jan. 28 | 100 | 100 | 100 | Feb. 28 | 100 | 100 | 100 |
| Jan. 29 | 100 | 100 | 100 | | | | |
| Jan. 30 | 100 | 100 | 100 | | | | |
| Jan. 31 | 100 | 100 | 100 | | | | |

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-5 DATE OF TEST Sept. 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:31 p.m. END 3:40 p.m.
 AVERAGE MOISTURE CONTENT 9.6% AVERAGE SPECIFIC GRAVITY .483

| | | | | | | | |
|--------|-------|-------|-------|--------|-------|-------|-------|
| 0 | .2000 | .1000 | .0000 | 24 000 | .2920 | .1970 | .0945 |
| 1 000 | .2000 | .1002 | .0001 | 25 000 | .2970 | .2015 | .0993 |
| 2 000 | .2000 | .1006 | .0003 | 26 000 | .3026 | .2075 | .1051 |
| 3 000 | .2001 | .1008 | .0004 | 27 000 | .3088 | .2140 | .1114 |
| 4 000 | .2012 | .1012 | .0012 | 28 000 | .3142 | .2200 | .1171 |
| 5 000 | .2032 | .1020 | .0026 | 29 000 | .3198 | .2260 | .1229 |
| 6 000 | .2065 | .1060 | .0062 | 30 000 | .3252 | .2320 | .1286 |
| 7 000 | .2152 | .1145 | .0148 | 31 000 | .3312 | .2385 | .1348 |
| 8 000 | .2200 | .1190 | .0195 | 32 000 | .3378 | .2450 | .1414 |
| 9 000 | .2248 | .1250 | .0249 | 33 000 | .3440 | .2520 | .1480 |
| 10 000 | .2293 | .1310 | .0301 | 34 000 | .3521 | .2610 | .1565 |
| 11 000 | .2330 | .1365 | .0348 | 35 000 | .3610 | .2700 | .1655 |
| 12 000 | .2370 | .1420 | .0395 | 36 000 | .3710 | .2810 | .1760 |
| 13 000 | .2418 | .1490 | .0454 | 37 000 | .3803 | .2905 | .1854 |
| 14 000 | .2462 | .1545 | .0503 | 38 000 | .3897 | .3010 | .1953 |
| 15 000 | .2508 | .1595 | .0551 | 39 000 | .4018 | .3140 | .2079 |
| 16 000 | .2545 | .1635 | .0590 | 40 000 | .4145 | .3275 | .2210 |
| 17 000 | .2590 | .1675 | .0632 | 41 000 | .4270 | .3400 | .2335 |
| 18 000 | .2642 | .1730 | .0686 | 42 000 | .4430 | .3570 | .2500 |
| 19 000 | .2690 | .1770 | .0730 | 43 000 | .4675 | .3815 | .2745 |
| 20 000 | .2732 | .1800 | .0766 | 43 750 | .4860 | .4020 | .2940 |
| 21 000 | .2803 | .1860 | .0832 | | | | |
| 22 000 | .2838 | .1880 | .0859 | | | | |
| 23 000 | .2877 | .1925 | .0901 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-6 DATE OF TEST Sept. 14, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 3:50 p.m. END 4:01 p.m.
 AVERAGE MOISTURE CONTENT 9.6% AVERAGE SPECIFIC GRAVITY .479

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .2000 | .0000 | 21 000 | .2880 | .2800 | .0840 |
| 1 000 | .2000 | .2005 | .0002 | 22 000 | .2920 | .2840 | .0880 |
| 2 000 | .2000 | .2009 | .0004 | 23 000 | .2950 | .2875 | .0913 |
| 3 000 | .2002 | .2016 | .0009 | 24 000 | .2982 | .2910 | .0946 |
| 4 000 | .2005 | .2025 | .0015 | 25 000 | .3018 | .2950 | .0984 |
| 5 000 | .2019 | .2045 | .0032 | 26 000 | .3052 | .2990 | .1021 |
| 6 000 | .2055 | .2080 | .0067 | 27 000 | .3097 | .3030 | .1063 |
| 7 000 | .2145 | .2130 | .0137 | 28 000 | .3141 | .3080 | .1110 |
| 8 000 | .2228 | .2185 | .0206 | 29 000 | .3191 | .3130 | .1160 |
| 9 000 | .2330 | .2265 | .0297 | 30 000 | .3241 | .3185 | .1213 |
| 10 000 | .2398 | .2330 | .0364 | 31 000 | .3300 | .3235 | .1267 |
| 11 000 | .2441 | .2380 | .0410 | 32 000 | .3358 | .3295 | .1326 |
| 12 000 | .2484 | .2425 | .0455 | 33 000 | .3418 | .3360 | .1389 |
| 13 000 | .2530 | .2480 | .0505 | 34 000 | .3480 | .3420 | .1450 |
| 14 000 | .2591 | .2535 | .0563 | 35 000 | .3552 | .3490 | .1521 |
| 15 000 | .2630 | .2580 | .0605 | 36 000 | .3630 | .3565 | .1597 |
| 16 000 | .2671 | .2610 | .0640 | 37 000 | .3722 | .3660 | .1691 |
| 17 000 | .2736 | .2670 | .0703 | 38 000 | .3808 | .3735 | .1771 |
| 18 000 | .2768 | .2700 | .0734 | 39 000 | .3918 | .3840 | .1879 |
| 19 000 | .2807 | .2730 | .0768 | 40 000 | .4140 | .4010 | .2075 |
| 20 000 | .2844 | .2770 | .0807 | | | | |

To be continued on next page.

Table 1
Summary of the data
collected from the
survey of the
population of the
area.

| Age Group | | | | Sex | | | |
|-----------|-------|-------|-------|--------|-------|-------|-------|
| Male | | | | Female | | | |
| 10-14 | 15-19 | 20-24 | 25-29 | 10-14 | 15-19 | 20-24 | 25-29 |
| 100 | 120 | 150 | 180 | 110 | 130 | 160 | 190 |
| 200 | 250 | 300 | 350 | 210 | 260 | 310 | 360 |
| 300 | 350 | 400 | 450 | 310 | 360 | 410 | 460 |
| 400 | 450 | 500 | 550 | 410 | 460 | 510 | 560 |
| 500 | 550 | 600 | 650 | 510 | 560 | 610 | 660 |
| 600 | 650 | 700 | 750 | 610 | 660 | 710 | 760 |
| 700 | 750 | 800 | 850 | 710 | 760 | 810 | 860 |
| 800 | 850 | 900 | 950 | 810 | 860 | 910 | 960 |
| 900 | 950 | 1000 | 1050 | 910 | 960 | 1010 | 1060 |
| 1000 | 1050 | 1100 | 1150 | 1010 | 1060 | 1110 | 1160 |
| 1100 | 1150 | 1200 | 1250 | 1110 | 1160 | 1210 | 1260 |
| 1200 | 1250 | 1300 | 1350 | 1210 | 1260 | 1310 | 1360 |
| 1300 | 1350 | 1400 | 1450 | 1310 | 1360 | 1410 | 1460 |
| 1400 | 1450 | 1500 | 1550 | 1410 | 1460 | 1510 | 1560 |
| 1500 | 1550 | 1600 | 1650 | 1510 | 1560 | 1610 | 1660 |
| 1600 | 1650 | 1700 | 1750 | 1610 | 1660 | 1710 | 1760 |
| 1700 | 1750 | 1800 | 1850 | 1710 | 1760 | 1810 | 1860 |
| 1800 | 1850 | 1900 | 1950 | 1810 | 1860 | 1910 | 1960 |
| 1900 | 1950 | 2000 | 2050 | 1910 | 1960 | 2010 | 2060 |
| 2000 | 2050 | 2100 | 2150 | 2010 | 2060 | 2110 | 2160 |
| 2100 | 2150 | 2200 | 2250 | 2110 | 2160 | 2210 | 2260 |
| 2200 | 2250 | 2300 | 2350 | 2210 | 2260 | 2310 | 2360 |
| 2300 | 2350 | 2400 | 2450 | 2310 | 2360 | 2410 | 2460 |
| 2400 | 2450 | 2500 | 2550 | 2410 | 2460 | 2510 | 2560 |
| 2500 | 2550 | 2600 | 2650 | 2510 | 2560 | 2610 | 2660 |
| 2600 | 2650 | 2700 | 2750 | 2610 | 2660 | 2710 | 2760 |
| 2700 | 2750 | 2800 | 2850 | 2710 | 2760 | 2810 | 2860 |
| 2800 | 2850 | 2900 | 2950 | 2810 | 2860 | 2910 | 2960 |
| 2900 | 2950 | 3000 | 3050 | 2910 | 2960 | 3010 | 3060 |
| 3000 | 3050 | 3100 | 3150 | 3010 | 3060 | 3110 | 3160 |
| 3100 | 3150 | 3200 | 3250 | 3110 | 3160 | 3210 | 3260 |
| 3200 | 3250 | 3300 | 3350 | 3210 | 3260 | 3310 | 3360 |
| 3300 | 3350 | 3400 | 3450 | 3310 | 3360 | 3410 | 3460 |
| 3400 | 3450 | 3500 | 3550 | 3410 | 3460 | 3510 | 3560 |
| 3500 | 3550 | 3600 | 3650 | 3510 | 3560 | 3610 | 3660 |
| 3600 | 3650 | 3700 | 3750 | 3610 | 3660 | 3710 | 3760 |
| 3700 | 3750 | 3800 | 3850 | 3710 | 3760 | 3810 | 3860 |
| 3800 | 3850 | 3900 | 3950 | 3810 | 3860 | 3910 | 3960 |
| 3900 | 3950 | 4000 | 4050 | 3910 | 3960 | 4010 | 4060 |
| 4000 | 4050 | 4100 | 4150 | 4010 | 4060 | 4110 | 4160 |
| 4100 | 4150 | 4200 | 4250 | 4110 | 4160 | 4210 | 4260 |
| 4200 | 4250 | 4300 | 4350 | 4210 | 4260 | 4310 | 4360 |
| 4300 | 4350 | 4400 | 4450 | 4310 | 4360 | 4410 | 4460 |
| 4400 | 4450 | 4500 | 4550 | 4410 | 4460 | 4510 | 4560 |
| 4500 | 4550 | 4600 | 4650 | 4510 | 4560 | 4610 | 4660 |
| 4600 | 4650 | 4700 | 4750 | 4610 | 4660 | 4710 | 4760 |
| 4700 | 4750 | 4800 | 4850 | 4710 | 4760 | 4810 | 4860 |
| 4800 | 4850 | 4900 | 4950 | 4810 | 4860 | 4910 | 4960 |
| 4900 | 4950 | 5000 | 5050 | 4910 | 4960 | 5010 | 5060 |
| 5000 | 5050 | 5100 | 5150 | 5010 | 5060 | 5110 | 5160 |
| 5100 | 5150 | 5200 | 5250 | 5110 | 5160 | 5210 | 5260 |
| 5200 | 5250 | 5300 | 5350 | 5210 | 5260 | 5310 | 5360 |
| 5300 | 5350 | 5400 | 5450 | 5310 | 5360 | 5410 | 5460 |
| 5400 | 5450 | 5500 | 5550 | 5410 | 5460 | 5510 | 5560 |
| 5500 | 5550 | 5600 | 5650 | 5510 | 5560 | 5610 | 5660 |
| 5600 | 5650 | 5700 | 5750 | 5610 | 5660 | 5710 | 5760 |
| 5700 | 5750 | 5800 | 5850 | 5710 | 5760 | 5810 | 5860 |
| 5800 | 5850 | 5900 | 5950 | 5810 | 5860 | 5910 | 5960 |
| 5900 | 5950 | 6000 | 6050 | 5910 | 5960 | 6010 | 6060 |
| 6000 | 6050 | 6100 | 6150 | 6010 | 6060 | 6110 | 6160 |
| 6100 | 6150 | 6200 | 6250 | 6110 | 6160 | 6210 | 6260 |
| 6200 | 6250 | 6300 | 6350 | 6210 | 6260 | 6310 | 6360 |
| 6300 | 6350 | 6400 | 6450 | 6310 | 6360 | 6410 | 6460 |
| 6400 | 6450 | 6500 | 6550 | 6410 | 6460 | 6510 | 6560 |
| 6500 | 6550 | 6600 | 6650 | 6510 | 6560 | 6610 | 6660 |
| 6600 | 6650 | 6700 | 6750 | 6610 | 6660 | 6710 | 6760 |
| 6700 | 6750 | 6800 | 6850 | 6710 | 6760 | 6810 | 6860 |
| 6800 | 6850 | 6900 | 6950 | 6810 | 6860 | 6910 | 6960 |
| 6900 | 6950 | 7000 | 7050 | 6910 | 6960 | 7010 | 7060 |
| 7000 | 7050 | 7100 | 7150 | 7010 | 7060 | 7110 | 7160 |
| 7100 | 7150 | 7200 | 7250 | 7110 | 7160 | 7210 | 7260 |
| 7200 | 7250 | 7300 | 7350 | 7210 | 7260 | 7310 | 7360 |
| 7300 | 7350 | 7400 | 7450 | 7310 | 7360 | 7410 | 7460 |
| 7400 | 7450 | 7500 | 7550 | 7410 | 7460 | 7510 | 7560 |
| 7500 | 7550 | 7600 | 7650 | 7510 | 7560 | 7610 | 7660 |
| 7600 | 7650 | 7700 | 7750 | 7610 | 7660 | 7710 | 7760 |
| 7700 | 7750 | 7800 | 7850 | 7710 | 7760 | 7810 | 7860 |
| 7800 | 7850 | 7900 | 7950 | 7810 | 7860 | 7910 | 7960 |
| 7900 | 7950 | 8000 | 8050 | 7910 | 7960 | 8010 | 8060 |
| 8000 | 8050 | 8100 | 8150 | 8010 | 8060 | 8110 | 8160 |
| 8100 | 8150 | 8200 | 8250 | 8110 | 8160 | 8210 | 8260 |
| 8200 | 8250 | 8300 | 8350 | 8210 | 8260 | 8310 | 8360 |
| 8300 | 8350 | 8400 | 8450 | 8310 | 8360 | 8410 | 8460 |
| 8400 | 8450 | 8500 | 8550 | 8410 | 8460 | 8510 | 8560 |
| 8500 | 8550 | 8600 | 8650 | 8510 | 8560 | 8610 | 8660 |
| 8600 | 8650 | 8700 | 8750 | 8610 | 8660 | 8710 | 8760 |
| 8700 | 8750 | 8800 | 8850 | 8710 | 8760 | 8810 | 8860 |
| 8800 | 8850 | 8900 | 8950 | 8810 | 8860 | 8910 | 8960 |
| 8900 | 8950 | 9000 | 9050 | 8910 | 8960 | 9010 | 9060 |
| 9000 | 9050 | 9100 | 9150 | 9010 | 9060 | 9110 | 9160 |
| 9100 | 9150 | 9200 | 9250 | 9110 | 9160 | 9210 | 9260 |
| 9200 | 9250 | 9300 | 9350 | 9210 | 9260 | 9310 | 9360 |
| 9300 | 9350 | 9400 | 9450 | 9310 | 9360 | 9410 | 9460 |
| 9400 | 9450 | 9500 | 9550 | 9410 | 9460 | 9510 | 9560 |
| 9500 | 9550 | 9600 | 9650 | 9510 | 9560 | 9610 | 9660 |
| 9600 | 9650 | 9700 | 9750 | 9610 | 9660 | 9710 | 9760 |
| 9700 | 9750 | 9800 | 9850 | 9710 | 9760 | 9810 | 9860 |
| 9800 | 9850 | 9900 | 9950 | 9810 | 9860 | 9910 | 9960 |
| 9900 | 9950 | 10000 | 10050 | 9910 | 9960 | 10010 | 10060 |
| 10000 | 10050 | 10100 | 10150 | 10010 | 10060 | 10110 | 10160 |
| 10100 | 10150 | 10200 | 10250 | 10110 | 10160 | 10210 | 10260 |
| 10200 | 10250 | 10300 | 10350 | 10210 | 10260 | 10310 | 10360 |
| 10300 | 10350 | 10400 | 10450 | 10310 | 10360 | 10410 | 10460 |
| 10400 | 10450 | 10500 | 10550 | 10410 | 10460 | 10510 | 10560 |
| 10500 | 10550 | 10600 | 10650 | 10510 | 10560 | 10610 | 10660 |
| 10600 | 10650 | 10700 | 10750 | 10610 | 10660 | 10710 | 10760 |
| 10700 | 10750 | 10800 | 10850 | 10710 | 10760 | 10810 | 10860 |
| 10800 | 10850 | 10900 | 10950 | 10810 | 10860 | 10910 | 10960 |
| 10900 | 10950 | 11000 | 11050 | 10910 | 10960 | 11010 | 11060 |
| 11000 | 11050 | 11100 | 11150 | 11010 | 11060 | 11110 | 11160 |
| 11100 | 11150 | 11200 | 11250 | 11110 | 11160 | 11210 | 11260 |
| 11200 | 11250 | 11300 | 11350 | 11210 | 11260 | 11310 | 11360 |
| 11300 | 11350 | 11400 | 11450 | 11310 | 11360 | 11410 | 11460 |
| 11400 | 11450 | 11500 | 11550 | 11410 | 11460 | 11510 | 11560 |
| 11500 | 11550 | 11600 | 11650 | 11510 | 11560 | 11610 | 11660 |
| 11600 | 11650 | 11700 | 11750 | 11610 | 11660 | 11710 | 11760 |
| 11700 | 11750 | 11800 | 11850 | 11710 | 11760 | 11810 | 11860 |
| 11800 | 11850 | 11900 | 11950 | 11810 | 11860 | 11910 | 11960 |
| 11900 | 11950 | 12000 | 12050 | 11910 | 11960 | 12010 | 12060 |
| 12000 | 12050 | 12100 | 12150 | 12010 | 12060 | 12110 | 12160 |
| 12100 | 12150 | 12200 | 12250 | 12110 | 12160 | 12210 | 12260 |
| 12200 | 12250 | 12300 | 12350 | 12210 | 12260 | 12310 | 12360 |
| 12300 | 12350 | 12400 | 12450 | 12310 | 12360 | 12410 | 12460 |
| 12400 | 12450 | 12500 | 12550 | 12410 | 12460 | 12510 | 12560 |
| 12500 | 12550 | 12600 | 12650 | 12510 | 12560 | 12610 | 12660 |
| 12600 | 12650 | 12700 | 12750 | 12610 | 12660 | 12710 | 12760 |
| 12700 | 12750 | 12800 | 12850 | 12710 | 12760 | 12810 | 12860 |
| 12800 | 12850 | 12900 | 12950 | 12810 | 12860 | 12910 | 12960 |
| 12900 | 12950 | 13000 | 13050 | 12910 | 12960 | 13010 | 13060 |
| 13000 | 13050 | 13100 | 13150 | 13010 | 13060 | 13110 | 13160 |
| 13100 | 13150 | 13200 | 13250 | 13110 | 13160 | 13210 | 13260 |
| 13200 | 13250 | 13300 | 13350 | 13210 | 13260 | 13310 | 13360 |
| 13300 | 13350 | 13400 | 13450 | 13310 | 13360 | 13410 | 13460 |
| 13400 | 13450 | 13500 | 13550 | 13410 | 13460 | 13510 | 13560 |
| 13500 | 13550 | 13600 | 13650 | 13510 | 13560 | 13610 | 13660 |
| 13600 | 13650 | 13700 | 13750 | 13610 | 13660 | 13710 | 13760 |
| 13700 | 13750 | 13800 | 13850 | 13710 | 13760 | 13810 | 13860 |
| 13800 | 13850 | 13900 | 13950 | 13810 | 13860 | 13910 | 13960 |
| 13900 | 13950 | 14000 | 14050 | 13910 | 13960 | 14010 | 14060 |
| 14000 | 14050 | 14100 | 14150 | 14010 | 14060 | 14110 | 14160 |
| 14100 | 14150 | 14200 | 14250 | 14110 | 14160 | 14210 | 14260 |
| 14200 | 14250 | 14300 | 14350 | 14210 | 14260 | 14310 | 14360 |
| 14300 | 14350 | 14400 | 14450 | 14310 | 14360 | 14410 | 14460 |
| 14400 | 14450 | 14500 | 14550 | 14410 | 14460 | 14510 | 14560 |
| 14500 | 14550 | 14600 | 14650 | 14510 | 14560 | 14610 | 14660 |
| 14600 | 14650 | 14700 | 14750 | 14610 | 14660 | 14710 | 14760 |
| 14700 | 14750 | 14800 | 14850 | 14710 | 14760 | 14810 | 14860 |
| 14800 | 14850 | 14900 | 14950 | 14810 | 14860 | 14910 | 14960 |
| 14900 | 14950 | 15000 | 15050 | 14910 | 14960 | 15010 | 15060 |
| 15000 | 15050 | 15100 | 15150 | 15010 | 15060 | 15110 | 15160 |
| 15100 | 15150 | 15200 | 15250 | 15110 | 15160 | 15210 | 15260 |
| 15200 | 15250 | 15300 | 15350 | 15210 | 15260 | 15310 | 15360 |
| 15300 | 15350 | 15400 | 15450 | 15310 | 15360 | 15410 | 15460 |
| 15400 | | | | | | | |

JOINT NO: C-6DATE OF TEST Sept. 14, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .4290 | .4140 | .2215 | | | | |
| 42 000 | .4457 | .4295 | .2376 | | | | |
| 43 000 | .4605 | .4435 | .2520 | | | | |
| 44 000 | .4800 | .4620 | .2710 | | | | |
| 45 000 | .5007 | .4810 | .2908 | | | | |
| 46 000 | .5248 | .5030 | .3139 | | | | |
| 47 000 | .5480 | .5250 | .3365 | | | | |
| 48 000 | .5760 | .5530 | .3645 | | | | |
| 48 400 | .6030 | .5770 | .3900 | | | | |

REMARKS: No dial jumping or cracking noise.
Piece 1 and 3 failed on both bolt lines.
Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-7 DATE OF TEST Sept. 15, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:47 a.m. END 10:01 a.m.
 AVERAGE MOISTURE CONTENT 10.0% AVERAGE SPECIFIC GRAVITY .580

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|------------------------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .0000 | .0000 | 22 000 | .1779 | .0760 | .0770 |
| 1 000 | .1001 | .0004 | .0002 | 23 000 | .1802 | .0790 | .0796 |
| 2 000 | .1002 | .0008 | .0005 | 24 000 | .1830 | .0825 | .0827 |
| 3 000 | .1004 | .0010 | .0007 | 25 000 | .1857 | .0860 | .0858 |
| 4 000 | .1006 | .0025 | .0015 | 26 000 | .1880 | .0900 | .0890 |
| 5 000 | .1020 | .0055 | .0038 | 27 000 | .1909 | .0935 | .0922 |
| 6 000 | .1050 | .0075 | .0112 | 28 000 | .1941 | .0975 | .0958 |
| 7 000 | .1267 | .0205 | .0236 | 29 000 | .1978 | .1020 | .0999 |
| 8 000 | .1335 | .0255 | .0295 | 30 000 | .2017 | .1065 | .1041 |
| 9 000 | .1385 | .0295 | .0340 | 31 000 | .2058 | .1110 | .1084 |
| 10 000 | .1427 | .0330 | .0379 | 32 000 | .2095 | .1155 | .1125 |
| 11 000 | .1460 | .0360 | .0410 | 33 000 | .2140 | .1205 | .1173 |
| 12 000 | .1488 | .0390 | .0439 | 34 000 | .2188 | .1260 | .1224 |
| 13 000 | .1519 | .0425 | .0462 | 35 000 | .2243 | .1320 | .1281 |
| 14 000 | .1547 | .0455 | .0501 | 36 000 | .2297 | .1375 | .1336 |
| 15 000 | .1573 | .0485 | .0529 | 37 000 | .2356 | .1435 | .1395 |
| 16 000 | .1600 | .0520 | .0560 | 38 000 | .2420 | .1500 | .1460 |
| 17 000 | .1630 | .0560 | .0595 | 39 000 | .2490 | .1570 | .1530 |
| 18 000 | .1661 | .0600 | .0630 | 40 000 | .2582 | .1655 | .1618 |
| 19 000 | .1690 | .0645 | .0667 | To be continued on next page | | | |
| 20 000 | .1721 | .0685 | .0703 | | | | |
| 21 000 | .1752 | .0725 | .0738 | | | | |

JOINT NO: C-7 DATE OF TEST Sept. 15, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .2663 | .1745 | .1704 | | | | |
| 42 000 | .2748 | .1830 | .1789 | | | | |
| 43 000 | .2840 | .1925 | .1882 | | | | |
| 44 000 | .2950 | .2040 | .1995 | | | | |
| 44 350 | .3020 | .2090 | .2055 | | | | |
| 45 000 | .3158 | .2235 | .2196 | | | | |
| 46 000 | .3294 | .2380 | .2340 | | | | |
| 47 000 | .3472 | .2550 | .2511 | | | | |
| 48 000 | .3680 | .2765 | .2723 | | | | |
| 49 000 | .3940 | .3020 | .2980 | | | | |
| 50 000 | .4180 | .3260 | .3220 | | | | |
| 50 300 | .4360 | .3435 | .3397 | | | | |
| 51 000 | .4735 | .3835 | .3785 | | | | |
| 52 000 | .4838 | .3930 | .3884 | | | | |
| 53 000 | .5030 | .4140 | .4115 | | | | |
| 54 000 | .5680 | .4800 | .4740 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on left bolt line.

| Date | | | | Time | | | |
|------|-------|------|------|------|-----|-----|------|
| Day | Month | Year | Hour | Min | Sec | Lat | Long |
| 1 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 2 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 3 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 4 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 5 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 6 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 7 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 8 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 9 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 10 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 11 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 12 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 13 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 14 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 15 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 16 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 17 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 18 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 19 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 20 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 21 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 22 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 23 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 24 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 25 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 26 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 27 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 28 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 29 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 30 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |
| 31 | Jan | 1900 | 12 | 00 | 00 | 00 | 00 |

. All the above are in the same direction : ...
 . small
 . All the above are in the same direction : ...

UNIVERSITY OF ALBERTA
DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-8 DATE OF TEST Sept. 15, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:23 a.m. END 10:33 a.m.
 AVERAGE MOISTURE CONTENT 9.6% AVERAGE SPECIFIC GRAVITY .501

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 22 000 | .1681 | .1785 | .0733 |
| 1 000 | .1001 | .1002 | .0002 | 23 000 | .1720 | .1820 | .0770 |
| 2 000 | .1003 | .1005 | .0004 | 24 000 | .1753 | .1855 | .0804 |
| 3 000 | .1008 | .1008 | .0008 | 25 000 | .1790 | .1895 | .0843 |
| 4 000 | .1011 | .1009 | .0010 | 26 000 | .1830 | .1935 | .0883 |
| 5 000 | .1030 | .1019 | .0025 | 27 000 | .1878 | .1980 | .0929 |
| 6 000 | .1047 | .1032 | .0040 | 28 000 | .1927 | .2030 | .0979 |
| 7 000 | .1168 | .1210 | .0189 | 29 000 | .1972 | .2080 | .1026 |
| 8 000 | .1212* | .1270 | .0241 | 30 000 | .2025 | .2130 | .1078 |
| 9 000 | .1252 | .1315 | .0284 | 31 000 | .2078 | .2185 | .1132 |
| 10 000 | .1278 | .1340 | .0309 | 32 000 | .2135 | .2245 | .1190 |
| 11 000 | .1296 | .1360 | .0328 | 33 000 | .2197 | .2310 | .1254 |
| 12 000 | .1323 | .1385 | .0354 | 34 000 | .2258 | .2370 | .1314 |
| 13 000 | .1353 | .1418 | .0386 | 35 000 | .2322 | .2435 | .1379 |
| 14 000 | .1386 | .1455 | .0421 | 36 000 | .2390 | .2510 | .1450 |
| 15 000 | .1420 | .1500 | .0460 | 37 000 | .2465 | .2590 | .1528 |
| 16 000 | .1452 | .1540 | .0496 | 38 000 | .2560 | .2685 | .1623 |
| 17 000 | .1500 | .1595 | .0548 | 39 000 | .2647 | .2770 | .1709 |
| 18 000 | .1535 | .1630 | .0583 | 40 000 | .2746 | .2870 | .1808 |
| 19 000 | .1563 | .1660 | .0612 | To be continued on next page. | | | |
| 20 000 | .1600 | .1700 | .0650 | | | | |
| 21 000 | .1630 | .1730 | .0680 | | | | |

JOINT NO: C-8 DATE OF TEST Sept. 15, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .2838 | .2955 | .1897 | | | | |
| 42 000 | .2953 | .3065 | .2009 | | | | |
| 43 000 | .3080 | .3190 | .2135 | | | | |
| 44 000 | .3230 | .3330 | .2280 | | | | |
| 45 000 | .3370 | .3480 | .2425 | | | | |
| 45 200 | .3418 | .3570 | .2494 | | | | |

REMARKS; Some dial jumping and cracking noise.
Pieces 1 and 3 failed on both bolt lines.
Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-9 DATE OF TEST Sept. 15, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:42 a.m. END 10:55 a.m.
 AVERAGE MOISTURE CONTENT 10.1% AVERAGE SPECIFIC GRAVITY .575

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 22 000 | .2402 | .1675 | .0539 |
| 1 000 | .2001 | -- | .0001 | 23 000 | .2425 | .1705 | .0565 |
| 2 000 | .2003 | .1002 | .0003 | 24 000 | .2448 | .1730 | .0589 |
| 3 000 | .2003 | .1005 | .0004 | 25 000 | .2470 | .1755 | .0613 |
| 4 000 | .2005 | .1010 | .0008 | 26 000 | .2494 | .1785 | .0640 |
| 5 000 | .2007 | .1018 | .0013 | 27 000 | .2517 | .1810 | .0664 |
| 6 000 | .2008 | .1028 | .0018 | 28 000 | .2542 | .1840 | .0691 |
| 7 000 | .2071 | .1160 | .0116 | 29 000 | .2570 | .1865 | .0718 |
| 8 000 | .2100 | .1210 | .0155 | 30 000 | .2598 | .1900 | .0749 |
| 9 000 | .2122 | .1255 | .0189 | 31 000 | .2630 | .1935 | .0783 |
| 10 000 | .2148 | .1290 | .0219 | 32 000 | .2665 | .1970 | .0818 |
| 11 000 | .2165 | .1320 | .0243 | 33 000 | .2706 | .2015 | .0861 |
| 12 000 | .2185 | .1360 | .0273 | 34 000 | .2750 | .2055 | .0903 |
| 13 000 | .2206 | .1400 | .0303 | 35 000 | .2788 | .2095 | .0942 |
| 14 000 | .2226 | .1435 | .0331 | 36 000 | .2838 | .2145 | .0992 |
| 15 000 | .2249 | .1470 | .0360 | 37 000 | .2894 | .2200 | .1047 |
| 16 000 | .2269 | .1500 | .0385 | 38 000 | .2951 | .2260 | .1106 |
| 17 000 | .2290 | .1530 | .0410 | 39 000 | .3017 | .2325 | .1171 |
| 18 000 | .2312 | .1565 | .0439 | 40 000 | .3084 | .2395 | .1240 |
| 19 000 | .2332 | .1590 | .0461 | To be continued on next page. | | | |
| 20 000 | .2356 | .1615 | .0486 | | | | |
| 21 000 | .2379 | .1645 | .0512 | | | | |

JOINT NO: C-9 DATE OF TEST Sept. 15, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .3160 | .2470 | .1315 | | | | |
| 42 000 | .3230 | .2550 | .1390 | | | | |
| 43 000 | .3320 | .2640 | .1480 | | | | |
| 44 000 | .3440 | .2780 | .1610 | | | | |
| 45 000 | .3550 | .2890 | .1720 | | | | |
| 46 000 | .3667 | .3005 | .1836 | | | | |
| 47 000 | .3776 | .3115 | .1946 | | | | |
| 48 000 | .3910 | .3250 | .2080 | | | | |
| 49 000 | .4076 | .3420 | .2248 | | | | |
| 50 000 | .4236 | .3575 | .2406 | | | | |
| 51 000 | .4438 | .3790 | .2614 | | | | |
| 52 000 | .4575 | .3930 | .2753 | | | | |
| 53 000 | .4720 | .4070 | .2895 | | | | |
| 54 000 | .4915 | .4270 | .3093 | | | | |
| 55 000 | .5135 | .4500 | .3318 | | | | |
| 56 000 | .5360 | .4730 | .3545 | | | | |
| 57 000 | .5600 | .4970 | .3785 | | | | |
| 58 000 | .5928 | .5290 | .4109 | | | | |
| 58 200 | .6070 | .5460 | .4265 | | | | |
| 59 000 | .6880 | .6250 | .5065 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-10 DATE OF TEST Sept. 15, 1959.
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:01 a.m. END 11:10 a.m.
 AVERAGE MOISTURE CONTENT 9.6% AVERAGE SPECIFIC GRAVITY .498

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .1632 | .2045 | .0839 |
| 1 000 | .1001 | .1001 | .0001 | 24 000 | .1658 | .2080 | .0869 |
| 2 000 | .1002 | .1005 | .0004 | 25 000 | .1685 | .2120 | .0903 |
| 3 000 | .1008 | .1008 | .0008 | 26 000 | .1710 | .2165 | .0938 |
| 4 000 | .1054 | .1035 | .0045 | 27 000 | .1738 | .2200 | .0969 |
| 5 000 | .1121 | .1245 | .0183 | 28 000 | .1770 | .2250 | .1010 |
| 6 000 | .1150 | .1305 | .0228 | 29 000 | .1800 | .2295 | .1048 |
| 7 000 | .1180 | .1365 | .0273 | 30 000 | .1838 | .2350 | .1094 |
| 8 000 | .1208 | .1420 | .0314 | 31 000 | .1880 | .2410 | .1145 |
| 9 000 | .1232 | .1480 | .0356 | 32 000 | .1932 | .2480 | .1206 |
| 10 000 | .1257 | .1530 | .0394 | 33 000 | .1992 | .2550 | .1271 |
| 11 000 | .1281 | .1590 | .0436 | 34 000 | .2052 | .2620 | .1336 |
| 12 000 | .1306 | .1630 | .0468 | 35 000 | .2130 | .2710 | .1420 |
| 13 000 | .1332 | .1675 | .0504 | 36 000 | .2210 | .2800 | .1505 |
| 14 000 | .1362 | .1710 | .0536 | 37 000 | .2300 | .2900 | .1600 |
| 15 000 | .1394 | .1750 | .0572 | 38 000 | .2396 | .3005 | .1701 |
| 16 000 | .1427 | .1785 | .0606 | 39 000 | .2510 | .3140 | .1825 |
| 17 000 | .1460 | .1820 | .0640 | 40 000 | .2648 | .3290 | .1969 |
| 18 000 | .1491 | .1860 | .0676 | 40 150 | .2680 | .3340 | .2010 |
| 19 000 | .1525 | .1895 | .0710 | 41 000 | .2830 | .3480 | .2155 |
| 20 000 | .1553 | .1930 | .0742 | 42 000 | .3010 | .3660 | .2335 |
| 21 000 | .1581 | .1965 | .0773 | 42 500 | .3130 | .3790 | .2460 |
| 22 000 | .1608 | .2000 | .0804 | 42 900 | -- | .4200 | -- |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-11 DATE OF TEST Sept. 15, 1959.RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:22 a.m. END 11:32 a.m.AVERAGE MOISTURE CONTENT 9.6% AVERAGE SPECIFIC GRAVITY .497

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 22 000 | .0580 | .1810 | .0695 |
| 1 000 | .0000 | .1001 | .0001 | 23 000 | .0607 | .1850 | .0729 |
| 2 000 | .0002 | .1004 | .0003 | 24 000 | .0638 | .1890 | .0764 |
| 3 000 | .0005 | .1008 | .0007 | 25 000 | .0672 | .1925 | .0799 |
| 4 000 | .0009 | .1020 | .0015 | 26 000 | .0708 | .1965 | .0837 |
| 5 000 | .0045 | .1050 | .0048 | 27 000 | .0748 | .2005 | .0877 |
| 6 000 | .0080 | .1120 | .0100 | 28 000 | .0790 | .2045 | .0918 |
| 7 000 | .0148 | .1205 | .0177 | 29 000 | .0837 | .2090 | .0964 |
| 8 000 | .0200 | .1270 | .0235 | 30 000 | .0884 | .2135 | .1010 |
| 9 000 | .0240 | .1320 | .0280 | 31 000 | .0932 | .2180 | .1056 |
| 10 000 | .0273 | .1370 | .0322 | 32 000 | .0988 | .2235 | .1112 |
| 11 000 | .0305 | .1410 | .0358 | 33 000 | .1052 | .2300 | .1176 |
| 12 000 | .0333 | .1450 | .0392 | 34 000 | .1123 | .2375 | .1249 |
| 13 000 | .0362 | .1490 | .0426 | 35 000 | .1202 | .2450 | .1326 |
| 14 000 | .0388 | .1525 | .0457 | 36 000 | .1290 | .2535 | .1413 |
| 15 000 | .0412 | .1565 | .0489 | 37 000 | .1383 | .2630 | .1507 |
| 16 000 | .0433 | .1595 | .0514 | 38 000 | .1487 | .2730 | .1609 |
| 17 000 | .0458 | .1630 | .0544 | 39 000 | .1598 | .2835 | .1717 |
| 18 000 | .0480 | .1660 | .0570 | 40 000 | .1720 | .2960 | .1840 |
| 19 000 | .0501 | .1695 | .0598 | To be continued on next page. | | | |
| 20 000 | .0523 | .1730 | .0627 | | | | |
| 21 000 | .0550 | .1765 | .0658 | | | | |

JOINT NO: C-11 DATE OF TEST Sept. 15, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .1860 | .3080 | .1970 | | | | |
| 42 000 | .1993 | .3220 | .2107 | | | | |
| 43 000 | .2192 | .3400 | .2296 | | | | |
| 44 000 | .2390 | .3610 | .2500 | | | | |
| 45 000 | .2583 | .3800 | .2692 | | | | |
| 46 000 | .2810 | .4040 | .2925 | | | | |
| 47 000 | .3050 | .4270 | .3160 | | | | |
| 48 000 | .3380 | .4600 | .3490 | | | | |
| 48 100 | .3480 | .4700 | .3590 | | | | |

REMARKS: No dial jumping or cracking noise.
Pieces 1 and 3 failed on both bolt lines.
Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-12 DATE OF TEST Sept. 15, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:37 a.m. END 11:47 a.m.
 AVERAGE MOISTURE CONTENT 9.6% AVERAGE SPECIFIC GRAVITY .511

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .2000 | .0000 | 22 000 | .1728 | .2750 | .0739 |
| 1 000 | .1002 | .2002 | .0002 | 23 000 | .1760 | .2790 | .0775 |
| 2 000 | .1005 | .2006 | .0006 | 24 000 | .1798 | .2830 | .0814 |
| 3 000 | .1010 | .2011 | .0011 | 25 000 | .1838 | .2875 | .0857 |
| 4 000 | .1040 | .2020 | .0030 | 26 000 | .1872 | .2910 | .0891 |
| 5 000 | .1081 | .2065 | .0073 | 27 000 | .1912 | .2945 | .0929 |
| 6 000 | .1175 | .2135 | .0155 | 28 000 | .1956 | .2990 | .0973 |
| 7 000 | .1223 | .2190 | .0207 | 29 000 | .2002 | .3035 | .1019 |
| 8 000 | .1269 | .2240 | .0252 | 30 000 | .2051 | .3080 | .1066 |
| 9 000 | .1308 | .2290 | .0299 | 31 000 | .2100 | .3130 | .1115 |
| 10 000 | .1346 | .2330 | .0338 | 32 000 | .2152 | .3180 | .1166 |
| 11 000 | .1390 | .2375 | .0383 | 33 000 | .2210 | .3235 | .1223 |
| 12 000 | .1428 | .2420 | .0424 | 34 000 | .2268 | .3295 | .1282 |
| 13 000 | .1463 | .2455 | .0459 | 35 000 | .2330 | .3350 | .1340 |
| 14 000 | .1503 | .2505 | .0504 | 36 000 | .2404 | .3430 | .1417 |
| 15 000 | .1528 | .2530 | .0529 | 37 000 | .2500 | .3520 | .1510 |
| 16 000 | .1560 | .2570 | .0565 | 38 000 | .2593 | .3610 | .1602 |
| 17 000 | .1581 | .2590 | .0586 | 39 000 | .2720 | .3730 | .1725 |
| 18 000 | .1610 | .2625 | .0618 | 40 000 | .2828 | .3830 | .1829 |
| 19 000 | .1642 | .2660 | .0651 | | | | |
| 20 000 | .1667 | .2680 | .0674 | To be continued on next page. | | | |
| 21 000 | .1694 | .2720 | .0707 | | | | |

JOINT NO: C-12DATE OF TEST Sept. 15, 1959.

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .2952 | .3945 | .1949 | | | | |
| 42 000 | .3087 | .4070 | .2079 | | | | |
| 43 000 | .3258 | .4240 | .2249 | | | | |
| 44 000 | .3402 | .4390 | .2396 | | | | |
| 45 000 | .3580 | .4560 | .2570 | | | | |
| 46 000 | .3790 | .4770 | .2780 | | | | |
| 47 000 | .4030 | .5010 | .3020 | | | | |
| 48 000 | .4288 | .5260 | .3269 | | | | |
| 49 000 | .4650 | .5620 | .3635 | | | | |
| 49 200 | .4850 | .6000 | .3925 | | | | |

REMARKS: Moderate dial jumping and cracking noise.
 Piece 1 failed on left bolt line and failed slightly on right bolt line.
 Piece 2 failed on right bolt line.
 Piece 3 failed on left bolt line and failed moderately on right bolt line.

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|-------|-------|-------|-------|-------|-------|-------|
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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: C-13 DATE OF TEST Sept. 16, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:32 a.m. END 9:40 a.m.AVERAGE MOISTURE CONTENT 9.5% AVERAGE SPECIFIC GRAVITY .482

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 23 000 | .2811 | .1780 | .0795 |
| 1 000 | .2001 | .1002 | .0001 | 24 000 | .2840 | .1810 | .0825 |
| 2 000 | .2002 | .1004 | .0003 | 25 000 | .2878 | .1840 | .0859 |
| 3 000 | .2005 | .1005 | .0005 | 26 000 | .2918 | .1875 | .0897 |
| 4 000 | .2009 | .1008 | .0008 | 27 000 | .2961 | .1910 | .0935 |
| 5 000 | .2012 | .1009 | .0010 | 28 000 | .3010 | .1950 | .0980 |
| 6 000 | .2033 | .1025 | .0029 | 29 000 | .3060 | .1995 | .1027 |
| 7 000 | .2110 | .1060 | .0085 | 30 000 | .3118 | .2040 | .1079 |
| 8 000 | .2183 | .1100 | .0142 | 31 000 | .3170 | .2085 | .1128 |
| 9 000 | .2243 | .1150 | .0197 | 32 000 | .3230 | .2135 | .1183 |
| 10 000 | .2292 | .1190 | .0241 | 33 000 | .3300 | .2190 | .1245 |
| 11 000 | .2342 | .1235 | .0289 | 34 000 | .3380 | .2255 | .1317 |
| 12 000 | .2414 | .1300 | .0357 | 35 000 | .3458 | .2320 | .1389 |
| 13 000 | .2482 | .1380 | .0431 | 36 000 | .3560 | .2400 | .1480 |
| 14 000 | .2528 | .1440 | .0488 | 37 000 | .3652 | .2470 | .1561 |
| 15 000 | .2574 | .1500 | .0537 | 38 000 | .3777 | .2580 | .1678 |
| 16 000 | .2610 | .1545 | .0578 | 39 000 | .3920 | .2710 | .1815 |
| 17 000 | .2632 | .1585 | .0609 | 40 000 | .4062 | .2840 | .1951 |
| 18 000 | .2662 | .1620 | .0641 | 41 000 | .4210 | .2980 | .2095 |
| 19 000 | .2688 | .1650 | .0669 | 42 000 | .4365 | .3130 | .2247 |
| 20 000 | .2717 | .1685 | .0701 | 43 000 | .4540 | .3300 | .2420 |
| 21 000 | .2743 | .1720 | .0731 | 44 000 | .4718 | .3460 | .2589 |
| 22 000 | .2777 | .1750 | .0764 | 44 250 | .4890 | .3530 | .2710 |

REMARKS: No dial jumping or cracking noise.

Piece 1 failed on right bolt line and failed slightly on left
bolt line.

Piece 2 failed on left bolt line.

Piece 3 failed on right bolt line and failed moderately on left
bolt line.

UNIVERSITY OF ALBERTA
DEPARTMENT OF CIVIL ENGINEERING
BOLTED JOINT TESTS

JOINT NO: C-14 DATE OF TEST Sept. 16, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:52 a.m. END 10:05 a.m.
 AVERAGE MOISTURE CONTENT 8.8% AVERAGE SPECIFIC GRAVITY .537

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .2000 | .0000 | 22 000 | .1101 | .2910 | .1005 |
| 1 000 | .0002 | .2002 | .0002 | 23 000 | .1158 | .2960 | .1059 |
| 2 000 | .0008 | .2005 | .0007 | 24 000 | .1208 | .3010 | .1109 |
| 3 000 | .0012 | .2006 | .0009 | 25 000 | .1258 | .3060 | .1159 |
| 4 000 | .0018 | .2009 | .0014 | 26 000 | .1320 | .3115 | .1217 |
| 5 000 | .0026 | .2012 | .0018 | 27 000 | .1374 | .3165 | .1269 |
| 6 000 | .0048 | .2018 | .0033 | 28 000 | .1421 | .3215 | .1318 |
| 7 000 | .0052 | .2021 | .0037 | 29 000 | .1480 | .3270 | .1375 |
| 8 000 | .0116 | .2050 | .0083 | 30 000 | .1540 | .3330 | .1435 |
| 9 000 | .0185 | .2110 | .0148 | 31 000 | .1607 | .3390 | .1498 |
| 10 000 | .0239 | .2155 | .0197 | 32 000 | .1658 | .3440 | .1549 |
| 11 000 | .0294 | .2200 | .0247 | 33 000 | .1721 | .3505 | .1613 |
| 12 000 | .0342 | .2250 | .0296 | 34 000 | .1788 | .3570 | .1679 |
| 13 000 | .0403 | .2295 | .0349 | 35 000 | .1856 | .3635 | .1745 |
| 14 000 | .0490 | .2370 | .0430 | 36 000 | .1934 | .3710 | .1822 |
| 15 000 | .0550 | .2420 | .0485 | 37 000 | .2018 | .3785 | .1901 |
| 16 000 | .0625 | .2485 | .0555 | 38 000 | .2107 | .3870 | .1988 |
| 17 000 | .0722 | .2575 | .0648 | 39 000 | .2202 | .3950 | .2076 |
| 18 000 | .0800 | .2645 | .0723 | 40 000 | .2318 | .4070 | .2194 |
| 19 000 | .0890 | .2725 | .0807 | To be continued on next page. | | | |
| 20 000 | .0963 | .2785 | .0874 | | | | |
| 21 000 | .1035 | .2850 | .0943 | | | | |

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| 11. Index | 145 |

JOINT NO: C-14 DATE OF TEST Sept. 16, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .2432 | .4180 | .2306 | | | | |
| 42 000 | .2552 | .4300 | .2426 | | | | |
| 43 000 | .2682 | .4425 | .2553 | | | | |
| 44 000 | .2827 | .4560 | .2693 | | | | |
| 45 000 | .2986 | .4710 | .2848 | | | | |
| 46 000 | .3160 | .4870 | .3015 | | | | |
| 47 000 | .3368 | .5060 | .3214 | | | | |
| 48 000 | .3612 | .5310 | .3461 | | | | |
| 48 900 | .3790 | .5740 | .3765 | | | | |

REMARKS: Considerable dial jumping and cracking noise.
Pieces 1 and 3 failed on left bolt line.
Piece 2 failed on right bolt line.

| 1900 | | | | 1901 | | | |
|------|--|--|--|------|--|--|--|
| Jan | | | | Feb | | | |
| 1902 | | | | 1903 | | | |
| 1904 | | | | 1905 | | | |
| 1906 | | | | 1907 | | | |
| 1908 | | | | 1909 | | | |
| 1910 | | | | 1911 | | | |
| 1912 | | | | 1913 | | | |
| 1914 | | | | 1915 | | | |
| 1916 | | | | 1917 | | | |
| 1918 | | | | 1919 | | | |
| 1920 | | | | 1921 | | | |
| 1922 | | | | 1923 | | | |
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| 1932 | | | | 1933 | | | |
| 1934 | | | | 1935 | | | |
| 1936 | | | | 1937 | | | |
| 1938 | | | | 1939 | | | |
| 1940 | | | | 1941 | | | |
| 1942 | | | | 1943 | | | |
| 1944 | | | | 1945 | | | |
| 1946 | | | | 1947 | | | |
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| 1952 | | | | 1953 | | | |
| 1954 | | | | 1955 | | | |
| 1956 | | | | 1957 | | | |
| 1958 | | | | 1959 | | | |
| 1960 | | | | 1961 | | | |
| 1962 | | | | 1963 | | | |
| 1964 | | | | 1965 | | | |
| 1966 | | | | 1967 | | | |
| 1968 | | | | 1969 | | | |
| 1970 | | | | 1971 | | | |
| 1972 | | | | 1973 | | | |
| 1974 | | | | 1975 | | | |
| 1976 | | | | 1977 | | | |
| 1978 | | | | 1979 | | | |
| 1980 | | | | 1981 | | | |
| 1982 | | | | 1983 | | | |
| 1984 | | | | 1985 | | | |
| 1986 | | | | 1987 | | | |
| 1988 | | | | 1989 | | | |
| 1990 | | | | 1991 | | | |
| 1992 | | | | 1993 | | | |
| 1994 | | | | 1995 | | | |
| 1996 | | | | 1997 | | | |
| 1998 | | | | 1999 | | | |
| 2000 | | | | 2001 | | | |
| 2002 | | | | 2003 | | | |
| 2004 | | | | 2005 | | | |
| 2006 | | | | 2007 | | | |
| 2008 | | | | 2009 | | | |
| 2010 | | | | 2011 | | | |
| 2012 | | | | 2013 | | | |
| 2014 | | | | 2015 | | | |
| 2016 | | | | 2017 | | | |
| 2018 | | | | 2019 | | | |
| 2020 | | | | 2021 | | | |
| 2022 | | | | 2023 | | | |
| 2024 | | | | 2025 | | | |
| 2026 | | | | 2027 | | | |
| 2028 | | | | 2029 | | | |
| 2030 | | | | 2031 | | | |
| 2032 | | | | 2033 | | | |
| 2034 | | | | 2035 | | | |
| 2036 | | | | 2037 | | | |
| 2038 | | | | 2039 | | | |
| 2040 | | | | 2041 | | | |
| 2042 | | | | 2043 | | | |
| 2044 | | | | 2045 | | | |
| 2046 | | | | 2047 | | | |
| 2048 | | | | 2049 | | | |
| 2050 | | | | 2051 | | | |
| 2052 | | | | 2053 | | | |
| 2054 | | | | 2055 | | | |
| 2056 | | | | 2057 | | | |
| 2058 | | | | 2059 | | | |
| 2060 | | | | 2061 | | | |
| 2062 | | | | 2063 | | | |
| 2064 | | | | 2065 | | | |

UNIVERSITY OF ALBERTA
DEPARTMENT OF CIVIL ENGINEERING
BOLTED JOINT TESTS

JOINT NO: C-15 DATE OF TEST Sept. 16, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:22 a.m. END 10:33 a.m.
 AVERAGE MOISTURE CONTENT 8.5% AVERAGE SPECIFIC GRAVITY .520

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .2000 | .0000 | 22 000 | .2016 | .3070 | .1043 |
| 1 000 | .1000 | .2008 | .0004 | 23 000 | .2088 | .3150 | .1119 |
| 2 000 | .1001 | .2010 | .0005 | 24 000 | .2152 | .3225 | .1188 |
| 3 000 | .1002 | .2012 | .0007 | 25 000 | .2218 | .3290 | .1254 |
| 4 000 | .1005 | .2015 | .0010 | 26 000 | .2273 | .3350 | .1312 |
| 5 000 | .1008 | .2020 | .0014 | 27 000 | .2328 | .3400 | .1364 |
| 6 000 | .1011 | .2028 | .0020 | 28 000 | .2386 | .3460 | .1423 |
| 7 000 | .1030 | .2045 | .0037 | 29 000 | .2440 | .3520 | .1480 |
| 8 000 | .1178 | .2190 | .0184 | 30 000 | .2502 | .3580 | .1541 |
| 9 000 | .1262 | .2290 | .0276 | 31 000 | .2563 | .3645 | .1604 |
| 10 000 | .1323 | .2365 | .0344 | 32 000 | .2628 | .3710 | .1669 |
| 11 000 | .1368 | .2415 | .0391 | 33 000 | .2700 | .3780 | .1740 |
| 12 000 | .1428 | .2480 | .0454 | 34 000 | .2771 | .3850 | .1810 |
| 13 000 | .1471 | .2525 | .0498 | 35 000 | .2848 | .3925 | .1886 |
| 14 000 | .1530 | .2585 | .0558 | 36 000 | .2930 | .4005 | .1967 |
| 15 000 | .1575 | .2620 | .0598 | 37 000 | .3028 | .4100 | .2064 |
| 16 000 | .1625 | .2670 | .0648 | 38 000 | .3124 | .4200 | .2162 |
| 17 000 | .1672 | .2725 | .0698 | 39 000 | .3242 | .4330 | .2286 |
| 18 000 | .1732 | .2780 | .0756 | 40 000 | .3377 | .4455 | .2416 |
| 19 000 | .1790 | .2840 | .0815 | To be continued on next page. | | | |
| 20 000 | .1860 | .2905 | .0882 | | | | |
| 21 000 | .1925 | .2980 | .0953 | | | | |

| ORIGINAL ARTICLES | | | | REVIEWS | | | |
|-------------------|-----|-----|-----|---------|-----|-----|------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 |
| 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 |
| 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
| 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 |
| 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 |
| 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 |
| 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 |
| 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 |
| 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 |
| 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 |
| 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 |
| 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 |
| 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 |
| 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 |
| 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 |
| 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 |
| 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |
| 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 |
| 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 |
| 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 |
| 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 |
| 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |
| 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 |
| 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 |
| 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 |
| 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 |
| 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 |
| 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 |
| 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 |
| 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 |
| 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 |
| 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 |
| 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 |
| 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 |
| 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 |
| 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 |
| 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 |
| 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 |
| 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 |
| 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 |
| 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 |
| 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 |
| 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 |
| 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 |
| 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 |
| 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 |
| 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 |
| 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 |
| 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 |
| 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 |
| 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 |
| 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 |
| 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 |
| 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 |
| 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 |
| 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 |
| 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 |
| 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 |
| 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 |
| 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 |
| 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 |
| 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 |
| 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 |
| 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 |
| 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 |
| 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 |
| 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 |
| 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 |
| 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 |
| 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 |
| 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 |
| 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 |
| 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 |
| 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 |
| 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 |
| 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 |
| 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 |
| 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 |
| 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 |
| 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 |
| 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 |
| 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 |
| 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 |
| 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 |
| 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 |
| 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 |
| 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 |
| 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 |
| 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 |
| 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 |
| 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 |
| 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 |
| 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 |
| 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 |
| 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 |
| 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 |
| 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 |
| 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 |
| 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 |
| 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 |
| 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 |
| 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 |
| 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 |
| 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 |
| 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 |
| 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 |
| 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 |
| 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 |
| 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 |
| 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 |
| 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 |
| 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 |
| 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 |
| 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 |
| 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 |
| 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 |
| 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 |

JOINT NO: C-15 DATE OF TEST Sept. 16, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 41 000 | .3558 | .4630 | .2594 | | | | |
| 41 500 | .3680 | .4770 | .2725 | | | | |
| 42 000 | .3838 | .4920 | .2879 | | | | |
| 42 200 | .3910 | .5050 | .2980 | | | | |
| 43 000 | .4490 | .5650 | .3570 | | | | |
| 43 500 | .4690 | .5870 | .3780 | | | | |

REMARKS: Considerable dial jumping and moderate cracking noise.
Piece 1 failed on both bolt lines.
Piece 2 failed on right bolt line.
Piece 3 failed on left bolt line.

... ..

| ... | ... | ... | ... | ... | ... | ... | ... |
|-----|-----|-----|-----|-----|-----|-----|-----|
| ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... |

... ..

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-1 DATE OF TEST Sept. 16, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:42 a.m. END 10:52 a.m.
 AVERAGE MOISTURE CONTENT 9.1% AVERAGE SPECIFIC GRAVITY .485

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2180 | .2140 | .1160 |
| 1 000 | .1400 | .1370 | .0385 | 24 000 | .2250 | .2210 | .1230 |
| 2 000 | .1518 | .1470 | .0494 | 25 000 | .2320 | .2280 | .1300 |
| 3 000 | .1580 | .1515 | .0548 | 26 000 | .2396 | .2355 | .1375 |
| 4 000 | .1620 | .1555 | .0588 | 27 000 | .2486 | .2445 | .1465 |
| 5 000 | .1653 | .1585 | .0619 | 28 000 | .2584 | .2545 | .1565 |
| 6 000 | .1681 | .1610 | .0645 | 29 000 | .2690 | .2650 | .1670 |
| 7 000 | .1703 | .1635 | .0669 | 30 000 | .2794 | .2760 | .1777 |
| 8 000 | .1728 | .1660 | .0694 | 31 000 | .2910 | .2880 | .1895 |
| 9 000 | .1750 | .1690 | .0720 | 32 000 | .3032 | .3010 | .2021 |
| 10 000 | .1771 | .1710 | .0740 | 33 000 | .3170 | .3140 | .2155 |
| 11 000 | .1792 | .1735 | .0763 | 34 000 | .3320 | .3290 | .2305 |
| 12 000 | .1812 | .1760 | .0786 | 34 500 | .3450 | .3420 | .2435 |
| 13 000 | .1838 | .1785 | .0811 | 35 000 | .3588 | .3550 | .2569 |
| 14 000 | .1862 | .1805 | .0833 | 36 000 | .3772 | .3730 | .2751 |
| 15 000 | .1886 | .1825 | .0855 | 37 000 | .3993 | .3960 | .2976 |
| 16 000 | .1910 | .1850 | .0880 | 37 300 | .4160 | .4120 | .3140 |
| 17 000 | .1936 | .1875 | .0905 | 38 000 | .4340 | .4300 | .3320 |
| 18 000 | .1966 | .1905 | .0935 | 39 000 | .4550 | .4500 | .3525 |
| 19 000 | .1993 | .1945 | .0969 | 40 000 | .4740 | .4680 | .3710 |
| 20 000 | .2029 | .1980 | .1005 | 41 000 | .4923 | .4860 | .3891 |
| 21 000 | .2070 | .2030 | .1050 | 42 000 | .5092 | .5025 | .4058 |
| 22 000 | .2120 | .2085 | .1102 | 42 200 | .5140 | .5100 | .4120 |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on right bolt line and failed slightly on left bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on both bolt lines.

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-2 DATE OF TEST: Sept. 16, 1959.
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:02 a.m. END 11:10 a.m.
 AVERAGE MOISTURE CONTENT 9.2% AVERAGE SPECIFIC GRAVITY .488

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .0000 | .0000 | 22 000 | .1736 | .1215 | .0951 |
| 1 000 | .1000 | .0150 | .0075 | 23 000 | .1790 | .1265 | .1027 |
| 2 000 | .1052 | .0470 | .0261 | 24 000 | .1846 | .1320 | .1083 |
| 3 000 | .1101 | .0550 | .0325 | 25 000 | .1907 | .1385 | .1146 |
| 4 000 | .1140 | .0605 | .0372 | 26 000 | .1980 | .1460 | .1220 |
| 5 000 | .1178 | .0650 | .0414 | 27 000 | .2053 | .1590 | .1321 |
| 6 000 | .1209 | .0690 | .0450 | 28 000 | .2145 | .1635 | .1390 |
| 7 000 | .1238 | .0730 | .0484 | 29 000 | .2232 | .1720 | .1476 |
| 8 000 | .1269 | .0760 | .0514 | 30 000 | .2338 | .1830 | .1584 |
| 9 000 | .1297 | .0790 | .0543 | 31 000 | .2458 | .1940 | .1699 |
| 10 000 | .1322 | .0820 | .0571 | 32 000 | .2593 | .2075 | .1834 |
| 11 000 | .1352 | .0850 | .0601 | 33 000 | .2743 | .2220 | .1981 |
| 12 000 | .1382 | .0880 | .0631 | 34 000 | .2910 | .2400 | .2155 |
| 13 000 | .1409 | .0910 | .0659 | 35 000 | .3086 | .2570 | .2328 |
| 14 000 | .1439 | .0940 | .0689 | 35 900 | .3380 | .2870 | .2625 |
| 15 000 | .1469 | .0970 | .0719 | | | | |
| 16 000 | .1498 | .1000 | .0749 | | | | |
| 17 000 | .1530 | .1030 | .0780 | | | | |
| 18 000 | .1569 | .1065 | .0817 | | | | |
| 19 000 | .1607 | .1100 | .0853 | | | | |
| 20 000 | .1647 | .1135 | .0891 | | | | |
| 21 000 | .1690 | .1175 | .0933 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on right bolt line and failed moderately on left bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on both bolt lines.

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-3 DATE OF TEST: Sept. 16, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:26 a.m. END 11:34 a.m.
 AVERAGE MOISTURE CONTENT 9.4% AVERAGE SPECIFIC GRAVITY .486

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 22 000 | .1100 | .1700 | .0900 |
| 1 000 | .0380 | .1003 | .0191 | 23 000 | .1145 | .1760 | .0952 |
| 2 000 | .0518 | .1005 | .0261 | 24 000 | .1192 | .1820 | .1006 |
| 3 000 | .0565 | .1030 | .0297 | 25 000 | .1257 | .1885 | .1071 |
| 4 000 | .0605 | .1065 | .0335 | 26 000 | .1325 | .1965 | .1145 |
| 5 000 | .0642 | .1090 | .0366 | 27 000 | .1404 | .2055 | .1229 |
| 6 000 | .0671 | .1120 | .0395 | 28 000 | .1488 | .2145 | .1316 |
| 7 000 | .0700 | .1150 | .0425 | 29 000 | .1579 | .2230 | .1404 |
| 8 000 | .0730 | .1175 | .0452 | 30 000 | .1684 | .2345 | .1514 |
| 9 000 | .0752 | .1205 | .0478 | 31 000 | .1786 | .2440 | .1613 |
| 10 000 | .0773 | .1235 | .0504 | 32 000 | .1920 | .2520 | .1720 |
| 11 000 | .0795 | .1265 | .0530 | 33 000 | .2050 | .2700 | .1875 |
| 12 000 | .0818 | .1290 | .0554 | 34 000 | .2206 | .2850 | .2028 |
| 13 000 | .0841 | .1320 | .0580 | 35 000 | .2362 | .3000 | .2181 |
| 14 000 | .0862 | .1350 | .0606 | 36 000 | .2550 | .3190 | .2370 |
| 15 000 | .0884 | .1385 | .0634 | 37 000 | .2750 | .3390 | .2570 |
| 16 000 | .0908 | .1420 | .0664 | 38 000 | .2980 | .3600 | .2790 |
| 17 000 | .0933 | .1455 | .0694 | 39 000 | .3240 | .3850 | .3045 |
| 18 000 | .0962 | .1500 | .0731 | 40 000 | .3480 | .4080 | .3280 |
| 19 000 | .0990 | .1545 | .0767 | 40 600 | .3590 | .4230 | .3410 |
| 20 000 | .1026 | .1595 | .0810 | | | | |
| 21 000 | .1063 | .1650 | .0856 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on both bolt lines.
 Piece 2 failed on left bolt line.
 Piece 3 failed on right bolt line and failed slightly on left
 bolt line.

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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-4 DATE OF TEST: Sept. 17, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:22 a.m. END 9:30 a.m.AVERAGE MOISTURE CONTENT 9.3% AVERAGE SPECIFIC GRAVITY .506

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .1928 | .2105 | .1016 |
| 1 000 | .1207 | .1320 | .0263 | 24 000 | .1980 | .2160 | .1070 |
| 2 000 | .1290 | .1420 | .0355 | 25 000 | .2036 | .2225 | .1130 |
| 3 000 | .1356 | .1480 | .0418 | 26 000 | .2098 | .2290 | .1194 |
| 4 000 | .1412 | .1530 | .0471 | 27 000 | .2165 | .2360 | .1262 |
| 5 000 | .1461 | .1570 | .0516 | 28 000 | .2241 | .2445 | .1343 |
| 6 000 | .1500 | .1600 | .0550 | 29 000 | .2322 | .2525 | .1423 |
| 7 000 | .1533 | .1635 | .0584 | 30 000 | .2422 | .2630 | .1526 |
| 8 000 | .1560 | .1660 | .0610 | 31 000 | .2530 | .2730 | .1630 |
| 9 000 | .1583 | .1685 | .0634 | 32 000 | .2643 | .2850 | .1746 |
| 10 000 | .1606 | .1710 | .0658 | 33 000 | .2758 | .2960 | .1859 |
| 11 000 | .1623 | .1740 | .0681 | 34 000 | .2912 | .3120 | .2016 |
| 12 000 | .1645 | .1765 | .0705 | 35 000 | .3052 | .3270 | .2161 |
| 13 000 | .1662 | .1785 | .0723 | 36 000 | .3207 | .3430 | .2318 |
| 14 000 | .1686 | .1810 | .0748 | 37 000 | .3380 | .3610 | .2495 |
| 15 000 | .1707 | .1835 | .0771 | 38 000 | .3578 | .3800 | .2689 |
| 16 000 | .1728 | .1860 | .0794 | 38 450 | .3712 | .3960 | .2836 |
| 17 000 | .1749 | .1885 | .0817 | 38 900 | .3900 | .4130 | .3015 |
| 18 000 | .1772 | .1915 | .0843 | | | | |
| 19 000 | .1797 | .1945 | .0871 | | | | |
| 20 000 | .1822 | .1975 | .0898 | | | | |
| 21 000 | .1852 | .2015 | .0933 | | | | |
| 22 000 | .1888 | .2055 | .0971 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on right bolt line and failed very slightly on left bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on right bolt line.

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| 1900-1909 | | | | | | | |
| Author | Title | Year | Volume | Page | Price | Notes | Ref. |
| Adams, John Quincy | Practical Mathematics | 1900 | 1 | 1-100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1901 | 2 | 101-200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1902 | 3 | 201-300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1903 | 4 | 301-400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1904 | 5 | 401-500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1905 | 6 | 501-600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1906 | 7 | 601-700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1907 | 8 | 701-800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1908 | 9 | 801-900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1909 | 10 | 901-1000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1910 | 11 | 1001-1100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1911 | 12 | 1101-1200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1912 | 13 | 1201-1300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1913 | 14 | 1301-1400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1914 | 15 | 1401-1500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1915 | 16 | 1501-1600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1916 | 17 | 1601-1700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1917 | 18 | 1701-1800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1918 | 19 | 1801-1900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1919 | 20 | 1901-2000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1920 | 21 | 2001-2100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1921 | 22 | 2101-2200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1922 | 23 | 2201-2300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1923 | 24 | 2301-2400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1924 | 25 | 2401-2500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1925 | 26 | 2501-2600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1926 | 27 | 2601-2700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1927 | 28 | 2701-2800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1928 | 29 | 2801-2900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1929 | 30 | 2901-3000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1930 | 31 | 3001-3100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1931 | 32 | 3101-3200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1932 | 33 | 3201-3300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1933 | 34 | 3301-3400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1934 | 35 | 3401-3500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1935 | 36 | 3501-3600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1936 | 37 | 3601-3700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1937 | 38 | 3701-3800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1938 | 39 | 3801-3900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1939 | 40 | 3901-4000 | \$1.00 | | |
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| Adams, John Quincy | Practical Mathematics | 1941 | 42 | 4101-4200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1942 | 43 | 4201-4300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1943 | 44 | 4301-4400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1944 | 45 | 4401-4500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1945 | 46 | 4501-4600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1946 | 47 | 4601-4700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1947 | 48 | 4701-4800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1948 | 49 | 4801-4900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1949 | 50 | 4901-5000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1950 | 51 | 5001-5100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1951 | 52 | 5101-5200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1952 | 53 | 5201-5300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1953 | 54 | 5301-5400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1954 | 55 | 5401-5500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1955 | 56 | 5501-5600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1956 | 57 | 5601-5700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1957 | 58 | 5701-5800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1958 | 59 | 5801-5900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1959 | 60 | 5901-6000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1960 | 61 | 6001-6100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1961 | 62 | 6101-6200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1962 | 63 | 6201-6300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1963 | 64 | 6301-6400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1964 | 65 | 6401-6500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1965 | 66 | 6501-6600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1966 | 67 | 6601-6700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1967 | 68 | 6701-6800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1968 | 69 | 6801-6900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1969 | 70 | 6901-7000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1970 | 71 | 7001-7100 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1971 | 72 | 7101-7200 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1972 | 73 | 7201-7300 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1973 | 74 | 7301-7400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1974 | 75 | 7401-7500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1975 | 76 | 7501-7600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1976 | 77 | 7601-7700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1977 | 78 | 7701-7800 | \$1.00 | | |
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| Adams, John Quincy | Practical Mathematics | 1979 | 80 | 7901-8000 | \$1.00 | | |
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| Adams, John Quincy | Practical Mathematics | 1982 | 83 | 8201-8300 | \$1.00 | | |
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| Adams, John Quincy | Practical Mathematics | 1984 | 85 | 8401-8500 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1985 | 86 | 8501-8600 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1986 | 87 | 8601-8700 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1987 | 88 | 8701-8800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1988 | 89 | 8801-8900 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1989 | 90 | 8901-9000 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1990 | 91 | 9001-9100 | \$1.00 | | |
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| Adams, John Quincy | Practical Mathematics | 1993 | 94 | 9301-9400 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1994 | 95 | 9401-9500 | \$1.00 | | |
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| Adams, John Quincy | Practical Mathematics | 1997 | 98 | 9701-9800 | \$1.00 | | |
| Adams, John Quincy | Practical Mathematics | 1998 | 99 | 9801-9900 | \$1.00 | | |
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DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-5 DATE OF TEST: Sept. 17, 1959RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:39 a.m. END 9:47 a.m.AVERAGE MOISTURE CONTENT 8.9% AVERAGE SPECIFIC GRAVITY .444

| LOAD | LEFT
DIAL | RIGHT
DIAL | AVE.
DEFLN. | LOAD | LEFT
DIAL | RIGHT
DIAL | AVE.
DEFLN. |
|--------|--------------|---------------|----------------|--------|--------------|---------------|----------------|
| 0 | .1000 | .1000 | .0000 | 24 000 | .2424 | .2270 | .1347 |
| 1 000 | .1200 | .1280 | .0240 | 25 000 | .2482 | .2350 | .1416 |
| 2 000 | .1342 | .1355 | .0348 | 26 000 | .2558 | .2440 | .1499 |
| 3 000 | .1447 | .1385 | .0416 | 27 000 | .2653 | .2550 | .1601 |
| 4 000 | .1532 | .1405 | .0468 | 28 000 | .2761 | .2660 | .1710 |
| 5 000 | .1602 | .1430 | .0516 | 29 000 | .2872 | .2775 | .1824 |
| 6 000 | .1648 | .1450 | .0549 | 30 000 | .2990 | .2900 | .1945 |
| 7 000 | .1692 | .1470 | .0581 | 31 000 | .3132 | .3040 | .2086 |
| 8 000 | .1735 | .1490 | .0612 | 32 000 | .3270 | .3180 | .2225 |
| 9 000 | .1772 | .1515 | .0643 | 33 000 | .3470 | .3380 | .2425 |
| 10 000 | .1811 | .1540 | .0675 | 34 000 | .3660 | .3560 | .2610 |
| 11 000 | .1842 | .1570 | .0706 | 35 000 | .3840 | .3730 | .2785 |
| 12 000 | .1883 | .1595 | .0739 | 36 000 | .4028 | .3930 | .2979 |
| 13 000 | .1927 | .1630 | .0778 | 36 100 | .4075 | .3990 | .3032 |
| 14 000 | .1970 | .1670 | .0820 | 37 000 | .4222 | .4150 | .3286 |
| 15 000 | .2021 | .1710 | .0865 | 38 000 | .4390 | .4330 | .3360 |
| 16 000 | .2069 | .1755 | .0912 | 39 000 | .4576 | .4520 | .3548 |
| 17 000 | .2120 | .1805 | .0962 | 39 950 | .4780 | .4700 | .3740 |
| 18 000 | .2167 | .1860 | .1013 | 40 000 | .5038 | .4950 | .3994 |
| 19 000 | .2211 | .1920 | .1065 | 40 250 | .5150 | .5080 | .4115 |
| 20 000 | .2250 | .1980 | .1115 | | | | |
| 21 000 | .2294 | .2050 | .1172 | | | | |
| 22 000 | .2336 | .2125 | .1230 | | | | |
| 23 000 | .2382 | .2200 | .1291 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on right bolt line.
 Piece 2 failed on left bolt line.

TABLE I
Summary of Results

Continued from page 122

| Group A | | | | Group B | | | |
|---------|------|------|----------|---------|------|------|----------|
| Run | Time | Temp | Pressure | Run | Time | Temp | Pressure |
| 1 | 1.2 | 100 | 1.0 | 1 | 1.5 | 105 | 1.2 |
| 2 | 1.5 | 102 | 1.1 | 2 | 1.8 | 108 | 1.3 |
| 3 | 1.8 | 104 | 1.2 | 3 | 2.1 | 110 | 1.4 |
| 4 | 2.1 | 106 | 1.3 | 4 | 2.4 | 112 | 1.5 |
| 5 | 2.4 | 108 | 1.4 | 5 | 2.7 | 114 | 1.6 |
| 6 | 2.7 | 110 | 1.5 | 6 | 3.0 | 116 | 1.7 |
| 7 | 3.0 | 112 | 1.6 | 7 | 3.3 | 118 | 1.8 |
| 8 | 3.3 | 114 | 1.7 | 8 | 3.6 | 120 | 1.9 |
| 9 | 3.6 | 116 | 1.8 | 9 | 3.9 | 122 | 2.0 |
| 10 | 3.9 | 118 | 1.9 | 10 | 4.2 | 124 | 2.1 |
| 11 | 4.2 | 120 | 2.0 | 11 | 4.5 | 126 | 2.2 |
| 12 | 4.5 | 122 | 2.1 | 12 | 4.8 | 128 | 2.3 |
| 13 | 4.8 | 124 | 2.2 | 13 | 5.1 | 130 | 2.4 |
| 14 | 5.1 | 126 | 2.3 | 14 | 5.4 | 132 | 2.5 |
| 15 | 5.4 | 128 | 2.4 | 15 | 5.7 | 134 | 2.6 |
| 16 | 5.7 | 130 | 2.5 | 16 | 6.0 | 136 | 2.7 |
| 17 | 6.0 | 132 | 2.6 | 17 | 6.3 | 138 | 2.8 |
| 18 | 6.3 | 134 | 2.7 | 18 | 6.6 | 140 | 2.9 |
| 19 | 6.6 | 136 | 2.8 | 19 | 6.9 | 142 | 3.0 |
| 20 | 6.9 | 138 | 2.9 | 20 | 7.2 | 144 | 3.1 |
| 21 | 7.2 | 140 | 3.0 | 21 | 7.5 | 146 | 3.2 |
| 22 | 7.5 | 142 | 3.1 | 22 | 7.8 | 148 | 3.3 |
| 23 | 7.8 | 144 | 3.2 | 23 | 8.1 | 150 | 3.4 |
| 24 | 8.1 | 146 | 3.3 | 24 | 8.4 | 152 | 3.5 |
| 25 | 8.4 | 148 | 3.4 | 25 | 8.7 | 154 | 3.6 |
| 26 | 8.7 | 150 | 3.5 | 26 | 9.0 | 156 | 3.7 |
| 27 | 9.0 | 152 | 3.6 | 27 | 9.3 | 158 | 3.8 |
| 28 | 9.3 | 154 | 3.7 | 28 | 9.6 | 160 | 3.9 |
| 29 | 9.6 | 156 | 3.8 | 29 | 9.9 | 162 | 4.0 |
| 30 | 9.9 | 158 | 3.9 | 30 | 10.2 | 164 | 4.1 |
| 31 | 10.2 | 160 | 4.0 | 31 | 10.5 | 166 | 4.2 |
| 32 | 10.5 | 162 | 4.1 | 32 | 10.8 | 168 | 4.3 |
| 33 | 10.8 | 164 | 4.2 | 33 | 11.1 | 170 | 4.4 |
| 34 | 11.1 | 166 | 4.3 | 34 | 11.4 | 172 | 4.5 |
| 35 | 11.4 | 168 | 4.4 | 35 | 11.7 | 174 | 4.6 |
| 36 | 11.7 | 170 | 4.5 | 36 | 12.0 | 176 | 4.7 |
| 37 | 12.0 | 172 | 4.6 | 37 | 12.3 | 178 | 4.8 |
| 38 | 12.3 | 174 | 4.7 | 38 | 12.6 | 180 | 4.9 |
| 39 | 12.6 | 176 | 4.8 | 39 | 12.9 | 182 | 5.0 |
| 40 | 12.9 | 178 | 4.9 | 40 | 13.2 | 184 | 5.1 |
| 41 | 13.2 | 180 | 5.0 | 41 | 13.5 | 186 | 5.2 |
| 42 | 13.5 | 182 | 5.1 | 42 | 13.8 | 188 | 5.3 |
| 43 | 13.8 | 184 | 5.2 | 43 | 14.1 | 190 | 5.4 |
| 44 | 14.1 | 186 | 5.3 | 44 | 14.4 | 192 | 5.5 |
| 45 | 14.4 | 188 | 5.4 | 45 | 14.7 | 194 | 5.6 |
| 46 | 14.7 | 190 | 5.5 | 46 | 15.0 | 196 | 5.7 |
| 47 | 15.0 | 192 | 5.6 | 47 | 15.3 | 198 | 5.8 |
| 48 | 15.3 | 194 | 5.7 | 48 | 15.6 | 200 | 5.9 |
| 49 | 15.6 | 196 | 5.8 | 49 | 15.9 | 202 | 6.0 |
| 50 | 15.9 | 198 | 5.9 | 50 | 16.2 | 204 | 6.1 |
| 51 | 16.2 | 200 | 6.0 | 51 | 16.5 | 206 | 6.2 |
| 52 | 16.5 | 202 | 6.1 | 52 | 16.8 | 208 | 6.3 |
| 53 | 16.8 | 204 | 6.2 | 53 | 17.1 | 210 | 6.4 |
| 54 | 17.1 | 206 | 6.3 | 54 | 17.4 | 212 | 6.5 |
| 55 | 17.4 | 208 | 6.4 | 55 | 17.7 | 214 | 6.6 |
| 56 | 17.7 | 210 | 6.5 | 56 | 18.0 | 216 | 6.7 |
| 57 | 18.0 | 212 | 6.6 | 57 | 18.3 | 218 | 6.8 |
| 58 | 18.3 | 214 | 6.7 | 58 | 18.6 | 220 | 6.9 |
| 59 | 18.6 | 216 | 6.8 | 59 | 18.9 | 222 | 7.0 |
| 60 | 18.9 | 218 | 6.9 | 60 | 19.2 | 224 | 7.1 |
| 61 | 19.2 | 220 | 7.0 | 61 | 19.5 | 226 | 7.2 |
| 62 | 19.5 | 222 | 7.1 | 62 | 19.8 | 228 | 7.3 |
| 63 | 19.8 | 224 | 7.2 | 63 | 20.1 | 230 | 7.4 |
| 64 | 20.1 | 226 | 7.3 | 64 | 20.4 | 232 | 7.5 |
| 65 | 20.4 | 228 | 7.4 | 65 | 20.7 | 234 | 7.6 |
| 66 | 20.7 | 230 | 7.5 | 66 | 21.0 | 236 | 7.7 |
| 67 | 21.0 | 232 | 7.6 | 67 | 21.3 | 238 | 7.8 |
| 68 | 21.3 | 234 | 7.7 | 68 | 21.6 | 240 | 7.9 |
| 69 | 21.6 | 236 | 7.8 | 69 | 21.9 | 242 | 8.0 |
| 70 | 21.9 | 238 | 7.9 | 70 | 22.2 | 244 | 8.1 |
| 71 | 22.2 | 240 | 8.0 | 71 | 22.5 | 246 | 8.2 |
| 72 | 22.5 | 242 | 8.1 | 72 | 22.8 | 248 | 8.3 |
| 73 | 22.8 | 244 | 8.2 | 73 | 23.1 | 250 | 8.4 |
| 74 | 23.1 | 246 | 8.3 | 74 | 23.4 | 252 | 8.5 |
| 75 | 23.4 | 248 | 8.4 | 75 | 23.7 | 254 | 8.6 |
| 76 | 23.7 | 250 | 8.5 | 76 | 24.0 | 256 | 8.7 |
| 77 | 24.0 | 252 | 8.6 | 77 | 24.3 | 258 | 8.8 |
| 78 | 24.3 | 254 | 8.7 | 78 | 24.6 | 260 | 8.9 |
| 79 | 24.6 | 256 | 8.8 | 79 | 24.9 | 262 | 9.0 |
| 80 | 24.9 | 258 | 8.9 | 80 | 25.2 | 264 | 9.1 |
| 81 | 25.2 | 260 | 9.0 | 81 | 25.5 | 266 | 9.2 |
| 82 | 25.5 | 262 | 9.1 | 82 | 25.8 | 268 | 9.3 |
| 83 | 25.8 | 264 | 9.2 | 83 | 26.1 | 270 | 9.4 |
| 84 | 26.1 | 266 | 9.3 | 84 | 26.4 | 272 | 9.5 |
| 85 | 26.4 | 268 | 9.4 | 85 | 26.7 | 274 | 9.6 |
| 86 | 26.7 | 270 | 9.5 | 86 | 27.0 | 276 | 9.7 |
| 87 | 27.0 | 272 | 9.6 | 87 | 27.3 | 278 | 9.8 |
| 88 | 27.3 | 274 | 9.7 | 88 | 27.6 | 280 | 9.9 |
| 89 | 27.6 | 276 | 9.8 | 89 | 27.9 | 282 | 10.0 |
| 90 | 27.9 | 278 | 9.9 | 90 | 28.2 | 284 | 10.1 |
| 91 | 28.2 | 280 | 10.0 | 91 | 28.5 | 286 | 10.2 |
| 92 | 28.5 | 282 | 10.1 | 92 | 28.8 | 288 | 10.3 |
| 93 | 28.8 | 284 | 10.2 | 93 | 29.1 | 290 | 10.4 |
| 94 | 29.1 | 286 | 10.3 | 94 | 29.4 | 292 | 10.5 |
| 95 | 29.4 | 288 | 10.4 | 95 | 29.7 | 294 | 10.6 |
| 96 | 29.7 | 290 | 10.5 | 96 | 30.0 | 296 | 10.7 |
| 97 | 30.0 | 292 | 10.6 | 97 | 30.3 | 298 | 10.8 |
| 98 | 30.3 | 294 | 10.7 | 98 | 30.6 | 300 | 10.9 |
| 99 | 30.6 | 296 | 10.8 | 99 | 30.9 | 302 | 11.0 |
| 100 | 30.9 | 298 | 10.9 | 100 | 31.2 | 304 | 11.1 |

Notes: 1. All runs were made at a constant pressure of 1.0 atm. 2. The temperature was measured at the midpoint of each run. 3. The time was measured from the start of the run to the end of the run.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-6 DATE OF TEST Sept. 17, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:54 a.m. END 10:02 a.m.
 AVERAGE MOISTURE CONTENT 9.4% AVERAGE SPECIFIC GRAVITY .538

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 22 000 | .1085 | .2280 | .1182 |
| 1 000 | .0242 | .1330 | .0286 | 23 000 | .1138 | .2340 | .1239 |
| 2 000 | .0371 | .1480 | .0425 | 24 000 | .1207 | .2410 | .1308 |
| 3 000 | .0450 | .1570 | .0510 | 25 000 | .1273 | .2470 | .1371 |
| 4 000 | .0507 | .1635 | .0571 | 26 000 | .1345 | .2550 | .1447 |
| 5 000 | .0547 | .1685 | .0616 | 26 700 | .1397 | .2640 | .1518 |
| 6 000 | .0580 | .1730 | .0655 | 27 000 | .1473 | .2710 | .1591 |
| 7 000 | .0611 | .1770 | .0690 | 28 000 | .1542 | .2770 | .1656 |
| 8 000 | .0641 | .1810 | .0725 | 29 000 | .1626 | .2850 | .1738 |
| 9 000 | .0672 | .1840 | .0756 | 30 000 | .1718 | .2940 | .1829 |
| 10 000 | .0708 | .1875 | .0791 | 31 000 | .1811 | .3035 | .1923 |
| 11 000 | .0732 | .1905 | .0819 | 32 000 | .1911 | .3130 | .2020 |
| 12 000 | .0764 | .1935 | .0849 | 33 000 | .2026 | .3240 | .2133 |
| 13 000 | .0793 | .1965 | .0879 | 34 000 | .2168 | .3380 | .2274 |
| 14 000 | .0820 | .1995 | .0907 | 35 000 | .2312 | .3525 | .2418 |
| 15 000 | .0848 | .2025 | .0936 | 35 950 | .2450 | .3670 | .2560 |
| 16 000 | .0872 | .2050 | .0961 | 36 000 | .2510 | .3720 | .2615 |
| 17 000 | .0900 | .2085 | .0992 | 37 000 | .2634 | .3850 | .2742 |
| 18 000 | .0926 | .2110 | .1018 | 38 000 | .2788 | .4000 | .2894 |
| 19 000 | .0956 | .2145 | .1050 | | | | |
| 20 000 | .0992 | .2185 | .1088 | To be continued on next page. | | | |
| 21 000 | .1032 | .2220 | .1126 | | | | |

TABLE I
Summary of the results of the
analysis of the data obtained from the
experiments on the effect of the
temperature on the rate of the
reaction.

| TABLE I
Summary of the results of the
analysis of the data obtained from the
experiments on the effect of the
temperature on the rate of the
reaction. | | | | | | | |
|---|----------------|----------------|-------------------|----------------|----------------|----------------|-------------------|
| Temp.
(°C.) | Time
(min.) | Concn.
(M.) | Rate
(M./min.) | Temp.
(°C.) | Time
(min.) | Concn.
(M.) | Rate
(M./min.) |
| 25 | 10 | 0.1 | 0.001 | 35 | 10 | 0.1 | 0.002 |
| 25 | 20 | 0.1 | 0.002 | 35 | 20 | 0.1 | 0.004 |
| 25 | 30 | 0.1 | 0.003 | 35 | 30 | 0.1 | 0.006 |
| 25 | 40 | 0.1 | 0.004 | 35 | 40 | 0.1 | 0.008 |
| 25 | 50 | 0.1 | 0.005 | 35 | 50 | 0.1 | 0.010 |
| 25 | 60 | 0.1 | 0.006 | 35 | 60 | 0.1 | 0.012 |
| 25 | 70 | 0.1 | 0.007 | 35 | 70 | 0.1 | 0.014 |
| 25 | 80 | 0.1 | 0.008 | 35 | 80 | 0.1 | 0.016 |
| 25 | 90 | 0.1 | 0.009 | 35 | 90 | 0.1 | 0.018 |
| 25 | 100 | 0.1 | 0.010 | 35 | 100 | 0.1 | 0.020 |
| 25 | 110 | 0.1 | 0.011 | 35 | 110 | 0.1 | 0.022 |
| 25 | 120 | 0.1 | 0.012 | 35 | 120 | 0.1 | 0.024 |
| 25 | 130 | 0.1 | 0.013 | 35 | 130 | 0.1 | 0.026 |
| 25 | 140 | 0.1 | 0.014 | 35 | 140 | 0.1 | 0.028 |
| 25 | 150 | 0.1 | 0.015 | 35 | 150 | 0.1 | 0.030 |
| 25 | 160 | 0.1 | 0.016 | 35 | 160 | 0.1 | 0.032 |
| 25 | 170 | 0.1 | 0.017 | 35 | 170 | 0.1 | 0.034 |
| 25 | 180 | 0.1 | 0.018 | 35 | 180 | 0.1 | 0.036 |
| 25 | 190 | 0.1 | 0.019 | 35 | 190 | 0.1 | 0.038 |
| 25 | 200 | 0.1 | 0.020 | 35 | 200 | 0.1 | 0.040 |
| 25 | 210 | 0.1 | 0.021 | 35 | 210 | 0.1 | 0.042 |
| 25 | 220 | 0.1 | 0.022 | 35 | 220 | 0.1 | 0.044 |
| 25 | 230 | 0.1 | 0.023 | 35 | 230 | 0.1 | 0.046 |
| 25 | 240 | 0.1 | 0.024 | 35 | 240 | 0.1 | 0.048 |
| 25 | 250 | 0.1 | 0.025 | 35 | 250 | 0.1 | 0.050 |
| 25 | 260 | 0.1 | 0.026 | 35 | 260 | 0.1 | 0.052 |
| 25 | 270 | 0.1 | 0.027 | 35 | 270 | 0.1 | 0.054 |
| 25 | 280 | 0.1 | 0.028 | 35 | 280 | 0.1 | 0.056 |
| 25 | 290 | 0.1 | 0.029 | 35 | 290 | 0.1 | 0.058 |
| 25 | 300 | 0.1 | 0.030 | 35 | 300 | 0.1 | 0.060 |
| 25 | 310 | 0.1 | 0.031 | 35 | 310 | 0.1 | 0.062 |
| 25 | 320 | 0.1 | 0.032 | 35 | 320 | 0.1 | 0.064 |
| 25 | 330 | 0.1 | 0.033 | 35 | 330 | 0.1 | 0.066 |
| 25 | 340 | 0.1 | 0.034 | 35 | 340 | 0.1 | 0.068 |
| 25 | 350 | 0.1 | 0.035 | 35 | 350 | 0.1 | 0.070 |
| 25 | 360 | 0.1 | 0.036 | 35 | 360 | 0.1 | 0.072 |
| 25 | 370 | 0.1 | 0.037 | 35 | 370 | 0.1 | 0.074 |
| 25 | 380 | 0.1 | 0.038 | 35 | 380 | 0.1 | 0.076 |
| 25 | 390 | 0.1 | 0.039 | 35 | 390 | 0.1 | 0.078 |
| 25 | 400 | 0.1 | 0.040 | 35 | 400 | 0.1 | 0.080 |
| 25 | 410 | 0.1 | 0.041 | 35 | 410 | 0.1 | 0.082 |
| 25 | 420 | 0.1 | 0.042 | 35 | 420 | 0.1 | 0.084 |
| 25 | 430 | 0.1 | 0.043 | 35 | 430 | 0.1 | 0.086 |
| 25 | 440 | 0.1 | 0.044 | 35 | 440 | 0.1 | 0.088 |
| 25 | 450 | 0.1 | 0.045 | 35 | 450 | 0.1 | 0.090 |
| 25 | 460 | 0.1 | 0.046 | 35 | 460 | 0.1 | 0.092 |
| 25 | 470 | 0.1 | 0.047 | 35 | 470 | 0.1 | 0.094 |
| 25 | 480 | 0.1 | 0.048 | 35 | 480 | 0.1 | 0.096 |
| 25 | 490 | 0.1 | 0.049 | 35 | 490 | 0.1 | 0.098 |
| 25 | 500 | 0.1 | 0.050 | 35 | 500 | 0.1 | 0.100 |
| 25 | 510 | 0.1 | 0.051 | 35 | 510 | 0.1 | 0.102 |
| 25 | 520 | 0.1 | 0.052 | 35 | 520 | 0.1 | 0.104 |
| 25 | 530 | 0.1 | 0.053 | 35 | 530 | 0.1 | 0.106 |
| 25 | 540 | 0.1 | 0.054 | 35 | 540 | 0.1 | 0.108 |
| 25 | 550 | 0.1 | 0.055 | 35 | 550 | 0.1 | 0.110 |
| 25 | 560 | 0.1 | 0.056 | 35 | 560 | 0.1 | 0.112 |
| 25 | 570 | 0.1 | 0.057 | 35 | 570 | 0.1 | 0.114 |
| 25 | 580 | 0.1 | 0.058 | 35 | 580 | 0.1 | 0.116 |
| 25 | 590 | 0.1 | 0.059 | 35 | 590 | 0.1 | 0.118 |
| 25 | 600 | 0.1 | 0.060 | 35 | 600 | 0.1 | 0.120 |
| 25 | 610 | 0.1 | 0.061 | 35 | 610 | 0.1 | 0.122 |
| 25 | 620 | 0.1 | 0.062 | 35 | 620 | 0.1 | 0.124 |
| 25 | 630 | 0.1 | 0.063 | 35 | 630 | 0.1 | 0.126 |
| 25 | 640 | 0.1 | 0.064 | 35 | 640 | 0.1 | 0.128 |
| 25 | 650 | 0.1 | 0.065 | 35 | 650 | 0.1 | 0.130 |
| 25 | 660 | 0.1 | 0.066 | 35 | 660 | 0.1 | 0.132 |
| 25 | 670 | 0.1 | 0.067 | 35 | 670 | 0.1 | 0.134 |
| 25 | 680 | 0.1 | 0.068 | 35 | 680 | 0.1 | 0.136 |
| 25 | 690 | 0.1 | 0.069 | 35 | 690 | 0.1 | 0.138 |
| 25 | 700 | 0.1 | 0.070 | 35 | 700 | 0.1 | 0.140 |
| 25 | 710 | 0.1 | 0.071 | 35 | 710 | 0.1 | 0.142 |
| 25 | 720 | 0.1 | 0.072 | 35 | 720 | 0.1 | 0.144 |
| 25 | 730 | 0.1 | 0.073 | 35 | 730 | 0.1 | 0.146 |
| 25 | 740 | 0.1 | 0.074 | 35 | 740 | 0.1 | 0.148 |
| 25 | 750 | 0.1 | 0.075 | 35 | 750 | 0.1 | 0.150 |
| 25 | 760 | 0.1 | 0.076 | 35 | 760 | 0.1 | 0.152 |
| 25 | 770 | 0.1 | 0.077 | 35 | 770 | 0.1 | 0.154 |
| 25 | 780 | 0.1 | 0.078 | 35 | 780 | 0.1 | 0.156 |
| 25 | 790 | 0.1 | 0.079 | 35 | 790 | 0.1 | 0.158 |
| 25 | 800 | 0.1 | 0.080 | 35 | 800 | 0.1 | 0.160 |
| 25 | 810 | 0.1 | 0.081 | 35 | 810 | 0.1 | 0.162 |
| 25 | 820 | 0.1 | 0.082 | 35 | 820 | 0.1 | 0.164 |
| 25 | 830 | 0.1 | 0.083 | 35 | 830 | 0.1 | 0.166 |
| 25 | 840 | 0.1 | 0.084 | 35 | 840 | 0.1 | 0.168 |
| 25 | 850 | 0.1 | 0.085 | 35 | 850 | 0.1 | 0.170 |
| 25 | 860 | 0.1 | 0.086 | 35 | 860 | 0.1 | 0.172 |
| 25 | 870 | 0.1 | 0.087 | 35 | 870 | 0.1 | 0.174 |
| 25 | 880 | 0.1 | 0.088 | 35 | 880 | 0.1 | 0.176 |
| 25 | 890 | 0.1 | 0.089 | 35 | 890 | 0.1 | 0.178 |
| 25 | 900 | 0.1 | 0.090 | 35 | 900 | 0.1 | 0.180 |
| 25 | 910 | 0.1 | 0.091 | 35 | 910 | 0.1 | 0.182 |
| 25 | 920 | 0.1 | 0.092 | 35 | 920 | 0.1 | 0.184 |
| 25 | 930 | 0.1 | 0.093 | 35 | 930 | 0.1 | 0.186 |
| 25 | 940 | 0.1 | 0.094 | 35 | 940 | 0.1 | 0.188 |
| 25 | 950 | 0.1 | 0.095 | 35 | 950 | 0.1 | 0.190 |
| 25 | 960 | 0.1 | 0.096 | 35 | 960 | 0.1 | 0.192 |
| 25 | 970 | 0.1 | 0.097 | 35 | 970 | 0.1 | 0.194 |
| 25 | 980 | 0.1 | 0.098 | 35 | 980 | 0.1 | 0.196 |
| 25 | 990 | 0.1 | 0.099 | 35 | 990 | 0.1 | 0.198 |
| 25 | 1000 | 0.1 | 0.100 | 35 | 1000 | 0.1 | 0.200 |
| 25 | 1010 | 0.1 | 0.101 | 35 | 1010 | 0.1 | 0.202 |
| 25 | 1020 | 0.1 | 0.102 | 35 | 1020 | 0.1 | 0.204 |
| 25 | 1030 | 0.1 | 0.103 | 35 | 1030 | 0.1 | 0.206 |
| 25 | 1040 | 0.1 | 0.104 | 35 | 1040 | 0.1 | 0.208 |
| 25 | 1050 | 0.1 | 0.105 | 35 | 1050 | 0.1 | 0.210 |
| 25 | 1060 | 0.1 | 0.106 | 35 | 1060 | 0.1 | 0.212 |
| 25 | 1070 | 0.1 | 0.107 | 35 | 1070 | 0.1 | 0.214 |
| 25 | 1080 | 0.1 | 0.108 | 35 | 1080 | 0.1 | 0.216 |
| 25 | 1090 | 0.1 | 0.109 | 35 | 1090 | 0.1 | 0.218 |
| 25 | 1100 | 0.1 | 0.110 | 35 | 1100 | 0.1 | 0.220 |
| 25 | 1110 | 0.1 | 0.111 | 35 | 1110 | 0.1 | 0.222 |
| 25 | 1120 | 0.1 | 0.112 | 35 | 1120 | 0.1 | 0.224 |
| 25 | 1130 | 0.1 | 0.113 | 35 | 1130 | 0.1 | 0.226 |
| 25 | 1140 | 0.1 | 0.114 | 35 | 1140 | 0.1 | 0.228 |
| 25 | 1150 | 0.1 | 0.115 | 35 | 1150 | 0.1 | 0.230 |
| 25 | 1160 | 0.1 | 0.116 | 35 | 1160 | 0.1 | 0.232 |
| 25 | 1170 | 0.1 | 0.117 | 35 | 1170 | 0.1 | 0.234 |
| 25 | 1180 | 0.1 | 0.118 | 35 | 1180 | 0.1 | 0.236 |
| 25 | 1190 | 0.1 | 0.119 | 35 | 1190 | 0.1 | 0.238 |
| 25 | 1200 | 0.1 | 0.120 | 35 | 1200 | 0.1 | 0.240 |
| 25 | 1210 | 0.1 | 0.121 | 35 | 1210 | 0.1 | 0.242 |
| 25 | 1220 | 0.1 | 0.122 | 35 | 1220 | 0.1 | 0.244 |
| 25 | 1230 | 0.1 | 0.123 | 35 | 1230 | 0.1 | 0.246 |
| 25 | 1240 | 0.1 | 0.124 | 35 | 1240 | 0.1 | 0.248 |
| 25 | 1250 | 0.1 | 0.125 | 35 | 1250 | 0.1 | 0.250 |
| 25 | 1260 | 0.1 | 0.126 | 35 | 1260 | 0.1 | 0.252 |
| 25 | 1270 | 0.1 | 0.127 | 35 | 1270 | 0.1 | 0.254 |
| 25 | 1280 | 0.1 | 0.128 | 35 | 1280 | 0.1 | 0.256 |
| 25 | 1290 | 0.1 | 0.129 | 35 | 1290 | 0.1 | 0.258 |
| 25 | 1300 | 0.1 | 0.130 | 35 | 1300 | 0.1 | 0.260 |
| 25 | 1310 | 0.1 | 0.131 | 35 | 1310 | 0.1 | 0.262 |
| 25 | 1320 | 0.1 | 0.132 | 35 | 1320 | 0.1 | 0.264 |
| 25 | 1330 | 0.1 | 0.133 | 35 | 1330 | 0.1 | 0.266 |
| 25 | 1340 | 0.1 | 0.134 | 35 | 1340 | 0.1 | 0.268 |
| 25 | 1350 | 0.1 | 0.135 | 35 | 1350 | 0.1 | 0.270 |
| 25 | 1360 | 0.1 | 0.136 | 35 | 1360 | 0.1 | 0.272 |
| 25 | 1370 | 0.1 | 0.137 | 35 | 1370 | 0.1 | 0.274 |
| 25 | 1380 | 0.1 | 0.138 | 35 | 1380 | 0.1 | 0.276 |
| 25 | 1390 | 0.1 | 0.139 | 35 | 1390 | 0.1 | 0.278 |
| 25 | 1400 | 0.1 | 0.140 | 35 | 1400 | 0.1 | 0.280 |
| 25 | 1410 | 0.1 | 0.141 | 35 | 1410 | 0.1 | 0.282 |
| 25 | 1420 | 0.1 | 0.142 | 35 | 1420 | 0.1 | 0.284 |
| 25 | 1430 | 0.1 | 0.143 | 35 | 1430 | 0.1 | 0.286 |
| 25 | 1440 | 0.1 | 0.144 | 35 | 1440 | 0.1 | 0.288 |
| 25 | 1450 | 0.1 | 0.145 | 35 | 1450 | 0.1 | 0.290 |
| 25 | 1460 | 0.1 | 0.146 | 35 | 1460 | 0.1 | 0.292 |
| 25 | 1470 | 0.1 | 0.147 | 35 | 1470 | 0.1 | 0.294 |
| 25 | 1480 | 0.1 | 0.148 | 35 | 1480 | 0.1 | 0.296 |
| 25 | 1490 | 0.1 | 0.149 | 35 | 1490 | 0.1 | 0.298 |
| 25 | 1500 | 0.1 | 0.150 | 35 | 1500 | 0.1 | 0.300 |
| 25 | 1510 | 0.1 | 0.151 | 35 | 1510 | 0.1 | 0.302 |
| 25 | 1520 | 0.1 | 0.152 | 35 | 1520 | 0.1 | 0.304 |
| 25 | 1530 | 0.1 | 0.153 | 35 | 1530 | 0.1 | 0.306 |
| 25 | 1540 | 0.1 | 0.154 | 35 | 1540 | 0.1 | 0.308 |
| 25 | 1550 | 0.1 | 0.155 | 35 | 1550 | 0.1 | 0.310 |
| 25 | 1560 | 0.1 | 0.156 | 35 | 1560 | 0.1 | 0.312 |
| 25 | 1570 | 0.1 | 0.157 | 35 | 1570 | 0.1 | 0.314 |
| 25 | 1580 | 0.1 | 0.158 | 35 | 1580 | 0.1 | 0.316 |
| 25 | 1590 | 0.1 | 0.159 | 35 | 1590 | 0.1 | 0.318 |
| 25 | 1600 | 0.1 | 0.160 | 35 | 1600 | 0.1 | 0.320 |
| 25 | 1610 | 0.1 | 0.161 | 35 | 1610 | 0.1 | 0.322 |
| 25 | 1620 | 0.1 | 0.162 | 35 | 1620 | 0.1 | 0.324 |
| 25 | 1630 | 0.1 | 0.163 | 35 | 1630 | 0.1 | 0.326 |
| 25 | 1640 | 0.1 | 0.164 | 35 | 1640 | 0.1 | 0.328 |
| 25 | 1650 | 0.1 | 0.165 | 35 | 1650 | 0.1 | 0.330 |
| 25 | 1660 | 0.1 | 0.166 | 35 | 1660 | 0.1 | 0.332 |
| 25 | 1670 | 0.1 | 0.167 | 35 | 1670 | 0.1 | 0.334 |
| 25 | 1680 | 0.1 | 0.168 | 35 | 1680 | 0.1 | 0.336 |
| 25 | 1690 | 0.1 | 0.169 | 35 | 1690 | 0.1 | 0.338 |
| 25 | 1700 | 0.1 | 0.170 | 35 | 1700 | 0.1 | 0.340 |
| 25</ | | | | | | | |

JOINT NO: D-6DATE OF TEST: Sept. 17, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 39 000 | .2944 | .4165 | .3054 | | | | |
| 40 000 | .3100 | .4320 | .3210 | | | | |
| 40 250 | .3193 | .4400 | .3296 | | | | |
| 40 750 | .3370 | .4530 | .3450 | | | | |
| 41 000 | .3530 | .4670 | .3600 | | | | |
| 41 300 | .3620 | .4770 | .3695 | | | | |
| 42 000 | .3895 | .5020 | .3957 | | | | |
| 43 000 | .4160 | .5250 | .4205 | | | | |
| 43 300 | .4320 | .5400 | .4360 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on both bolt lines.
 Piece 2 failed on left bolt line.
 Piece 3 failed on right bolt line and failed slightly on left
 bolt line.

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Chapter I. Introduction

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| | | | |
|---|----|----|----|
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |

| | | | |
|----|----|----|----|
| 13 | 14 | 15 | 16 |
| 17 | 18 | 19 | 20 |

| | | | |
|----|----|----|----|
| 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 |

| | | | |
|----|----|----|----|
| 29 | 30 | 31 | 32 |
| 33 | 34 | 35 | 36 |

| | | | |
|----|----|----|----|
| 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 |

| | | | |
|----|----|----|----|
| 45 | 46 | 47 | 48 |
| 49 | 50 | 51 | 52 |

| | | | |
|----|----|----|----|
| 53 | 54 | 55 | 56 |
| 57 | 58 | 59 | 60 |

| | | | |
|----|----|----|----|
| 61 | 62 | 63 | 64 |
| 65 | 66 | 67 | 68 |

| | | | |
|----|----|----|----|
| 69 | 70 | 71 | 72 |
| 73 | 74 | 75 | 76 |

| | | | |
|----|----|----|----|
| 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 |

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-7 DATE OF TEST: Sept. 17, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:25 a.m. END 10:37 a.m.
 AVERAGE MOISTURE CONTENT 9.5% AVERAGE SPECIFIC GRAVITY .565

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------------------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .1890 | .1945 | .0917 |
| 1 000 | .1230 | .1250 | .0240 | 24 000 | .1938 | .1985 | .0961 |
| 2 000 | .1298 | .1355 | .0326 | 25 000 | .1984 | .2030 | .1007 |
| 3 000 | .1348 | .1420 | .0384 | 26 000 | .2041 | .2080 | .1060 |
| 4 000 | .1390 | .1475 | .0432 | 27 000 | .2100 | .2140 | .1120 |
| 5 000 | .1420 | .1520 | .0470 | 28 000 | .2170 | .2215 | .1192 |
| 6 000 | .1447 | .1550 | .0498 | 29 000 | .2247 | .2290 | .1268 |
| 7 000 | .1471 | .1585 | .0528 | 30 000 | .2323 | .2375 | .1349 |
| 8 000 | .1497 | .1610 | .0553 | 31 000 | .2406 | .2460 | .1433 |
| 9 000 | .1519 | .1635 | .0577 | 32 000 | .2492 | .2555 | .1523 |
| 10 000 | .1542 | .1655 | .0598 | 33 000 | .2590 | .2670 | .1630 |
| 11 000 | .1561 | .1675 | .0618 | 34 000 | .2696 | .2800 | .1748 |
| 12 000 | .1582 | .1700 | .0641 | 35 000 | .2793 | .2915 | .1854 |
| 13 000 | .1605 | .1720 | .0662 | 36 000 | .2900 | .3020 | .1960 |
| 14 000 | .1627 | .1740 | .0683 | 37 000 | .3002 | .3130 | .2066 |
| 15 000 | .1656 | .1755 | .0705 | 38 000 | .3119 | .3250 | .2184 |
| 16 000 | .1677 | .1775 | .0726 | 39 000 | .3264 | .3400 | .2332 |
| 17 000 | .1702 | .1795 | .0749 | 40 000 | .3428 | .3575 | .2501 |
| 18 000 | .1728 | .1815 | .0771 | 41 000 | .3592 | .3750 | .2671 |
| 19 000 | .1757 | .1835 | .0796 | 42 000 | .3760 | .3925 | .2842 |
| 20 000 | .1787 | .1860 | .0823 | To be continued on next page. | | | |
| 21 000 | .1817 | .1885 | .0851 | | | | |
| 22 000 | .1854 | .1915 | .0884 | | | | |

TABLE I SUMMARY OF THE DATA FOR THE YEAR 1950

| January | | | | February | | | |
|---------|-------|------|--------|----------|-------|------|--------|
| Day | Temp. | Wind | Clouds | Day | Temp. | Wind | Clouds |
| 1 | 32 | 10 | 100 | 1 | 35 | 12 | 100 |
| 2 | 30 | 8 | 100 | 2 | 33 | 10 | 100 |
| 3 | 28 | 6 | 100 | 3 | 31 | 8 | 100 |
| 4 | 26 | 4 | 100 | 4 | 29 | 6 | 100 |
| 5 | 24 | 2 | 100 | 5 | 27 | 4 | 100 |
| 6 | 22 | 0 | 100 | 6 | 25 | 2 | 100 |
| 7 | 20 | 0 | 100 | 7 | 23 | 0 | 100 |
| 8 | 18 | 0 | 100 | 8 | 21 | 0 | 100 |
| 9 | 16 | 0 | 100 | 9 | 19 | 0 | 100 |
| 10 | 14 | 0 | 100 | 10 | 17 | 0 | 100 |
| 11 | 12 | 0 | 100 | 11 | 15 | 0 | 100 |
| 12 | 10 | 0 | 100 | 12 | 13 | 0 | 100 |
| 13 | 8 | 0 | 100 | 13 | 11 | 0 | 100 |
| 14 | 6 | 0 | 100 | 14 | 9 | 0 | 100 |
| 15 | 4 | 0 | 100 | 15 | 7 | 0 | 100 |
| 16 | 2 | 0 | 100 | 16 | 5 | 0 | 100 |
| 17 | 0 | 0 | 100 | 17 | 3 | 0 | 100 |
| 18 | -2 | 0 | 100 | 18 | 1 | 0 | 100 |
| 19 | -4 | 0 | 100 | 19 | -1 | 0 | 100 |
| 20 | -6 | 0 | 100 | 20 | -3 | 0 | 100 |
| 21 | -8 | 0 | 100 | 21 | -5 | 0 | 100 |
| 22 | -10 | 0 | 100 | 22 | -7 | 0 | 100 |
| 23 | -12 | 0 | 100 | 23 | -9 | 0 | 100 |
| 24 | -14 | 0 | 100 | 24 | -11 | 0 | 100 |
| 25 | -16 | 0 | 100 | 25 | -13 | 0 | 100 |
| 26 | -18 | 0 | 100 | 26 | -15 | 0 | 100 |
| 27 | -20 | 0 | 100 | 27 | -17 | 0 | 100 |
| 28 | -22 | 0 | 100 | 28 | -19 | 0 | 100 |
| 29 | -24 | 0 | 100 | 29 | -21 | 0 | 100 |
| 30 | -26 | 0 | 100 | 30 | -23 | 0 | 100 |
| 31 | -28 | 0 | 100 | 31 | -25 | 0 | 100 |

JOINT NO: D-7 DATE OF TEST: Sept. 17, 1959

CONTINUED FROM PREVIOUS PAGE

| LOAD | LEFT | RIGHT | AVE. | LOAD | LEFT | RIGHT | AVE. |
|--------|-------|-------|--------|------|------|-------|--------|
| LB. | DIAL | DIAL | DEFLN. | LB. | DIAL | DIAL | DEFLN. |
| | IN. | IN. | IN. | | IN. | IN. | IN. |
| 43 000 | .3928 | .4100 | .3014 | | | | |
| 44 000 | .4088 | .4270 | .3179 | | | | |
| 45 000 | .4228 | .4420 | .3324 | | | | |
| 46 000 | .4360 | .4550 | .3455 | | | | |
| 47 000 | .4520 | .4730 | .3625 | | | | |
| 48 000 | .4707 | .4900 | .3803 | | | | |
| 49 000 | .4852 | .5050 | .3951 | | | | |
| 50 000 | .5016 | .5220 | .4118 | | | | |
| 51 000 | .5203 | .5400 | .4301 | | | | |
| 52 000 | .5374 | .5570 | .4472 | | | | |
| 53 000 | .5520 | .5720 | .4620 | | | | |
| 54 000 | .5730 | .5920 | .4825 | | | | |
| 55 000 | .5950 | .6140 | .5045 | | | | |
| 56 000 | .6240 | .6420 | .5330 | | | | |
| 56 400 | .6490 | .6750 | .5620 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

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BOLTED JOINT TESTS

JOINT NO: D-8 DATE OF TEST: Sept. 17, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:47 a.m. END 10:55 a.m.
 AVERAGE MOISTURE CONTENT 9.2% AVERAGE SPECIFIC GRAVITY .495

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 23 000 | .0870 | .1860 | .0865 |
| 1 000 | .0201 | .1095 | .0148 | 24 000 | .0922 | .1915 | .0918 |
| 2 000 | .0246 | .1175 | .0210 | 25 000 | .0990 | .1980 | .0985 |
| 3 000 | .0284 | .1240 | .0262 | 26 000 | .1063 | .2055 | .1059 |
| 4 000 | .0318 | -- | .0318 | 27 000 | .1147 | .2140 | .1143 |
| 5 000 | .0343 | .1325 | .0334 | 28 000 | .1235 | .2230 | .1232 |
| 6 000 | .0371 | .1360 | .0365 | 29 000 | .1334 | .2330 | .1332 |
| 7 000 | .0396 | .1390 | .0393 | 30 000 | .1440 | .2430 | .1435 |
| 8 000 | .0420 | .1420 | .0420 | 31 000 | .1551 | .2540 | .1545 |
| 9 000 | .0440 | .1445 | .0442 | 32 000 | .1670 | .2650 | .1660 |
| 10 000 | .0463 | .1470 | .0467 | 33 000 | .1817 | .2780 | .1798 |
| 11 000 | .0489 | .1490 | .0490 | 34 000 | .1960 | .2920 | .1940 |
| 12 000 | .0512 | .1515 | .0514 | 35 000 | .2124 | .3080 | .2002 |
| 13 000 | .0535 | .1540 | .0537 | 35 700 | .2250 | .3230 | .2240 |
| 14 000 | .0562 | .1565 | .0564 | 36 000 | .2400 | .3370 | .2385 |
| 15 000 | .0590 | .1590 | .0590 | 37 000 | .2574 | .3550 | .2562 |
| 16 000 | .0620 | .1620 | .0620 | 38 000 | .2780 | .3740 | .2760 |
| 17 000 | .0647 | .1650 | .0648 | 38 600 | .2940 | .3850 | .2895 |
| 18 000 | .0680 | .1680 | .0680 | 38 700 | .3430 | .4280 | .3355 |
| 19 000 | .0712 | .1715 | .0713 | | | | |
| 20 000 | .0748 | .1750 | .0749 | | | | |
| 21 000 | .0782 | .1780 | .0781 | | | | |
| 22 000 | .0822 | .1820 | .0821 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on both bolt lines.
 Piece 2 failed on right bolt line.
 Piece 3 failed on right bolt line and failed moderately on left
 bolt line

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BOLTED JOINT TESTS

JOINT NO: D-9 DATE OF TEST: Sept. 17, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:04 a.m. END 11:12 a.m.
 AVERAGE MOISTURE CONTENT 9.1% AVERAGE SPECIFIC GRAVITY .479

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .2109 | .1915 | .1012 |
| 1 000 | .1343 | .1170 | .0256 | 24 000 | .2172 | .1975 | .1073 |
| 2 000 | .1427 | .1245 | .0336 | 25 000 | .2236 | .2040 | .1138 |
| 3 000 | .1482 | .1300 | .0391 | 26 000 | .2314 | .2115 | .1214 |
| 4 000 | .1520 | .1350 | .0435 | 27 000 | .2391 | .2195 | .1293 |
| 5 000 | .1547 | .1385 | .0466 | 28 000 | .2478 | .2285 | .1381 |
| 6 000 | .1571 | .1425 | .0498 | 29 000 | .2572 | .2385 | .1478 |
| 7 000 | .1597 | .1465 | .0531 | 30 000 | .2670 | .2485 | .1577 |
| 8 000 | .1621 | .1490 | .0555 | 31 000 | .2777 | .2595 | .1686 |
| 9 000 | .1645 | .1520 | .0582 | 32 000 | .2900 | .2720 | .1810 |
| 10 000 | .1668 | .1545 | .0606 | 33 000 | .3030 | .2845 | .1937 |
| 11 000 | .1690 | .1570 | .0630 | 34 000 | .3160 | .2975 | .2067 |
| 12 000 | .1713 | .1595 | .0654 | 35 000 | .3300 | .3115 | .2207 |
| 13 000 | .1736 | .1620 | .0678 | 35 250 | .3375 | .3180 | .2277 |
| 14 000 | .1760 | .1645 | .0702 | 35 400 | .4075 | .3850 | .2962 |
| 15 000 | .1785 | .1670 | .0727 | 35 450 | Ultimate | ..... | ..... |
| 16 000 | .1812 | .1690 | .0751 | | Load | | |
| 17 000 | .1843 | .1715 | .0779 | | | | |
| 18 000 | .1878 | .1745 | .0811 | | | | |
| 19 000 | .1917 | .1770 | .0843 | | | | |
| 20 000 | .1960 | .1800 | .0880 | | | | |
| 21 000 | .2006 | .1835 | .0920 | | | | |
| 22 000 | .2054 | .1870 | .0962 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on right bolt line.
 Piece 2 failed on left bolt line.
 Piece 3 failed on right bolt line.

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BOLTED JOINT TESTS

JOINT NO: D-10 DATE OF TEST: Sept. 18, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 9:45 a.m. END 9:53 a.m.
 AVERAGE MOISTURE CONTENT 9.4% AVERAGE SPECIFIC GRAVITY .488

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 23 000 | .1178 | .2015 | .1096 |
| 1 000 | .0327 | .1230 | .0278 | 24 000 | .1237 | .2065 | .1151 |
| 2 000 | .0412 | .1315 | .0363 | 25 000 | .1298 | .2115 | .1206 |
| 3 000 | .0462 | .1370 | .0416 | 26 000 | .1365 | .2170 | .1267 |
| 4 000 | .0500 | .1415 | .0458 | 27 000 | .1456 | .2255 | .1355 |
| 5 000 | .0537 | .1455 | .0496 | 28 000 | .1552 | .2345 | .1448 |
| 6 000 | .0570 | .1485 | .0527 | 29 000 | .1647 | .2435 | .1541 |
| 7 000 | .0600 | .1515 | .0558 | 30 000 | .1772 | .2550 | .1661 |
| 8 000 | .0630 | .1545 | .0587 | 31 000 | .1896 | .2665 | .1780 |
| 9 000 | .0658 | .1570 | .0614 | 32 000 | .2014 | .2780 | .1897 |
| 10 000 | .0685 | .1595 | .0640 | 33 000 | .2141 | .2900 | .2020 |
| 11 000 | .0711 | .1620 | .0665 | 34 000 | .2310 | .3060 | .2185 |
| 12 000 | .0740 | .1645 | .0692 | 35 000 | .2447 | .3190 | .2318 |
| 13 000 | .0768 | .1670 | .0719 | 36 000 | .2613 | .3365 | .2489 |
| 14 000 | .0798 | .1695 | .0746 | 37 000 | .2840 | .3575 | .2707 |
| 15 000 | .0828 | .1720 | .0774 | 37 650 | .3030 | .3740 | .2885 |
| 16 000 | .0858 | .1745 | .0801 | 38 000 | .3380 | .4120 | .3250 |
| 17 000 | .0892 | .1770 | .0831 | 39 000 | .3623 | .4390 | .3506 |
| 18 000 | .0928 | .1805 | .0866 | 40 000 | .3915 | .4700 | .3807 |
| 19 000 | .0970 | .1840 | .0905 | 40 200 | ..... | .4780 | ..... |
| 20 000 | .1012 | .1880 | .0946 | | | | |
| 21 000 | .1067 | .1920 | .0993 | | | | |
| 22 000 | .1118 | .1970 | .1044 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on left bolt line.

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BOLTED JOINT TESTS

JOINT NO: D-11 DATE OF TEST: Sept. 18, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:19 a.m. END 10:26 a.m.
 AVERAGE MOISTURE CONTENT 8.8% AVERAGE SPECIFIC GRAVITY .456

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 23 000 | .2867 | .2085 | .0976 |
| 1 000 | .2094 | .1270 | .0182 | 24 000 | .2922 | .2150 | .1036 |
| 2 000 | .2112 | .1365 | .0238 | 25 000 | .2994 | .2225 | .1110 |
| 3 000 | .2161 | .1410 | .0285 | 26 000 | .3068 | .2310 | .1189 |
| 4 000 | .2206 | .1445 | .0325 | 27 000 | .3145 | .2390 | .1267 |
| 5 000 | .2248 | .1480 | .0364 | 28 000 | .3237 | .2485 | .1361 |
| 6 000 | .2290 | .1510 | .0400 | 29 000 | .3337 | .2580 | .1458 |
| 7 000 | .2323 | .1545 | .0434 | 30 000 | .3448 | .2700 | .1574 |
| 8 000 | .2360 | .1570 | .0465 | 31 000 | .3572 | .2820 | .1696 |
| 9 000 | .2398 | .1605 | .0501 | 32 000 | .3710 | .2960 | .1835 |
| 10 000 | .2428 | .1630 | .0529 | 33 000 | .3852 | .3110 | .1981 |
| 11 000 | .2459 | .1660 | .0559 | 34 000 | .4003 | .3260 | .2131 |
| 12 000 | .2488 | .1685 | .0586 | 35 000 | .4142 | .3410 | .2276 |
| 13 000 | .2514 | .1715 | .0614 | 36 000 | .4333 | .3600 | .2466 |
| 14 000 | .2542 | .1740 | .0641 | 36 700 | .4490 | .3750 | .2620 |
| 15 000 | .2571 | .1770 | .0670 | 37 000 | .5010 | .4200 | .3105 |
| 16 000 | .2600 | .1795 | .0697 | 37 350 | .5150 | .4310 | .3230 |
| 17 000 | .2629 | .1825 | .0727 | | | | |
| 18 000 | .2663 | .1855 | .0759 | | | | |
| 19 000 | .2698 | .1890 | .0794 | | | | |
| 20 000 | .2731 | .1930 | .0830 | | | | |
| 21 000 | .2772 | .1975 | .0873 | | | | |
| 22 000 | .2819 | .2030 | .0924 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on left bolt line.
 Piece 2 failed on right bolt line.
 Piece 3 failed on both bolt lines.

TABLE I
Summary of the results of the
analysis of the data obtained from the
experiments on the effect of the
temperature on the rate of the
reaction.

| Experiment No. 1 | | | | Experiment No. 2 | | | |
|------------------|------------|--------------|---------|------------------|------------|--------------|---------|
| Time, min. | Temp., °C. | Rate, %/min. | Remarks | Time, min. | Temp., °C. | Rate, %/min. | Remarks |
| 0 | 25 | 0 | | 0 | 25 | 0 | |
| 10 | 25 | 1.2 | | 10 | 25 | 1.1 | |
| 20 | 25 | 2.4 | | 20 | 25 | 2.2 | |
| 30 | 25 | 3.6 | | 30 | 25 | 3.3 | |
| 40 | 25 | 4.8 | | 40 | 25 | 4.4 | |
| 50 | 25 | 6.0 | | 50 | 25 | 5.5 | |
| 60 | 25 | 7.2 | | 60 | 25 | 6.6 | |
| 70 | 25 | 8.4 | | 70 | 25 | 7.7 | |
| 80 | 25 | 9.6 | | 80 | 25 | 8.8 | |
| 90 | 25 | 10.8 | | 90 | 25 | 9.9 | |
| 100 | 25 | 12.0 | | 100 | 25 | 11.0 | |
| 110 | 25 | 13.2 | | 110 | 25 | 12.1 | |
| 120 | 25 | 14.4 | | 120 | 25 | 13.2 | |
| 130 | 25 | 15.6 | | 130 | 25 | 14.3 | |
| 140 | 25 | 16.8 | | 140 | 25 | 15.4 | |
| 150 | 25 | 18.0 | | 150 | 25 | 16.5 | |
| 160 | 25 | 19.2 | | 160 | 25 | 17.6 | |
| 170 | 25 | 20.4 | | 170 | 25 | 18.7 | |
| 180 | 25 | 21.6 | | 180 | 25 | 19.8 | |
| 190 | 25 | 22.8 | | 190 | 25 | 20.9 | |
| 200 | 25 | 24.0 | | 200 | 25 | 22.0 | |
| 210 | 25 | 25.2 | | 210 | 25 | 23.1 | |
| 220 | 25 | 26.4 | | 220 | 25 | 24.2 | |
| 230 | 25 | 27.6 | | 230 | 25 | 25.3 | |
| 240 | 25 | 28.8 | | 240 | 25 | 26.4 | |
| 250 | 25 | 30.0 | | 250 | 25 | 27.5 | |
| 260 | 25 | 31.2 | | 260 | 25 | 28.6 | |
| 270 | 25 | 32.4 | | 270 | 25 | 29.7 | |
| 280 | 25 | 33.6 | | 280 | 25 | 30.8 | |
| 290 | 25 | 34.8 | | 290 | 25 | 31.9 | |
| 300 | 25 | 36.0 | | 300 | 25 | 33.0 | |
| 310 | 25 | 37.2 | | 310 | 25 | 34.1 | |
| 320 | 25 | 38.4 | | 320 | 25 | 35.2 | |
| 330 | 25 | 39.6 | | 330 | 25 | 36.3 | |
| 340 | 25 | 40.8 | | 340 | 25 | 37.4 | |
| 350 | 25 | 42.0 | | 350 | 25 | 38.5 | |
| 360 | 25 | 43.2 | | 360 | 25 | 39.6 | |
| 370 | 25 | 44.4 | | 370 | 25 | 40.7 | |
| 380 | 25 | 45.6 | | 380 | 25 | 41.8 | |
| 390 | 25 | 46.8 | | 390 | 25 | 42.9 | |
| 400 | 25 | 48.0 | | 400 | 25 | 44.0 | |
| 410 | 25 | 49.2 | | 410 | 25 | 45.1 | |
| 420 | 25 | 50.4 | | 420 | 25 | 46.2 | |
| 430 | 25 | 51.6 | | 430 | 25 | 47.3 | |
| 440 | 25 | 52.8 | | 440 | 25 | 48.4 | |
| 450 | 25 | 54.0 | | 450 | 25 | 49.5 | |
| 460 | 25 | 55.2 | | 460 | 25 | 50.6 | |
| 470 | 25 | 56.4 | | 470 | 25 | 51.7 | |
| 480 | 25 | 57.6 | | 480 | 25 | 52.8 | |
| 490 | 25 | 58.8 | | 490 | 25 | 53.9 | |
| 500 | 25 | 60.0 | | 500 | 25 | 55.0 | |
| 510 | 25 | 61.2 | | 510 | 25 | 56.1 | |
| 520 | 25 | 62.4 | | 520 | 25 | 57.2 | |
| 530 | 25 | 63.6 | | 530 | 25 | 58.3 | |
| 540 | 25 | 64.8 | | 540 | 25 | 59.4 | |
| 550 | 25 | 66.0 | | 550 | 25 | 60.5 | |
| 560 | 25 | 67.2 | | 560 | 25 | 61.6 | |
| 570 | 25 | 68.4 | | 570 | 25 | 62.7 | |
| 580 | 25 | 69.6 | | 580 | 25 | 63.8 | |
| 590 | 25 | 70.8 | | 590 | 25 | 64.9 | |
| 600 | 25 | 72.0 | | 600 | 25 | 66.0 | |
| 610 | 25 | 73.2 | | 610 | 25 | 67.1 | |
| 620 | 25 | 74.4 | | 620 | 25 | 68.2 | |
| 630 | 25 | 75.6 | | 630 | 25 | 69.3 | |
| 640 | 25 | 76.8 | | 640 | 25 | 70.4 | |
| 650 | 25 | 78.0 | | 650 | 25 | 71.5 | |
| 660 | 25 | 79.2 | | 660 | 25 | 72.6 | |
| 670 | 25 | 80.4 | | 670 | 25 | 73.7 | |
| 680 | 25 | 81.6 | | 680 | 25 | 74.8 | |
| 690 | 25 | 82.8 | | 690 | 25 | 75.9 | |
| 700 | 25 | 84.0 | | 700 | 25 | 77.0 | |
| 710 | 25 | 85.2 | | 710 | 25 | 78.1 | |
| 720 | 25 | 86.4 | | 720 | 25 | 79.2 | |
| 730 | 25 | 87.6 | | 730 | 25 | 80.3 | |
| 740 | 25 | 88.8 | | 740 | 25 | 81.4 | |
| 750 | 25 | 90.0 | | 750 | 25 | 82.5 | |
| 760 | 25 | 91.2 | | 760 | 25 | 83.6 | |
| 770 | 25 | 92.4 | | 770 | 25 | 84.7 | |
| 780 | 25 | 93.6 | | 780 | 25 | 85.8 | |
| 790 | 25 | 94.8 | | 790 | 25 | 86.9 | |
| 800 | 25 | 96.0 | | 800 | 25 | 88.0 | |
| 810 | 25 | 97.2 | | 810 | 25 | 89.1 | |
| 820 | 25 | 98.4 | | 820 | 25 | 90.2 | |
| 830 | 25 | 99.6 | | 830 | 25 | 91.3 | |
| 840 | 25 | 100.8 | | 840 | 25 | 92.4 | |
| 850 | 25 | 102.0 | | 850 | 25 | 93.5 | |
| 860 | 25 | 103.2 | | 860 | 25 | 94.6 | |
| 870 | 25 | 104.4 | | 870 | 25 | 95.7 | |
| 880 | 25 | 105.6 | | 880 | 25 | 96.8 | |
| 890 | 25 | 106.8 | | 890 | 25 | 97.9 | |
| 900 | 25 | 108.0 | | 900 | 25 | 99.0 | |
| 910 | 25 | 109.2 | | 910 | 25 | 100.1 | |
| 920 | 25 | 110.4 | | 920 | 25 | 101.2 | |
| 930 | 25 | 111.6 | | 930 | 25 | 102.3 | |
| 940 | 25 | 112.8 | | 940 | 25 | 103.4 | |
| 950 | 25 | 114.0 | | 950 | 25 | 104.5 | |
| 960 | 25 | 115.2 | | 960 | 25 | 105.6 | |
| 970 | 25 | 116.4 | | 970 | 25 | 106.7 | |
| 980 | 25 | 117.6 | | 980 | 25 | 107.8 | |
| 990 | 25 | 118.8 | | 990 | 25 | 108.9 | |
| 1000 | 25 | 120.0 | | 1000 | 25 | 110.0 | |

Notes: (a) The temperature was maintained constant at 25°C. throughout the experiment. (b) The rate of reaction was determined by measuring the amount of product formed per unit time. (c) The data were plotted on a graph of rate versus time, and a straight line was obtained, indicating that the reaction was first order. (d) The slope of the line was used to determine the rate constant, k, which was found to be 0.0012 min⁻¹.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-12 DATE OF TEST: Sept. 18, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:32 a.m. END 10:40 a.m.
 AVERAGE MOISTURE CONTENT 9.3% AVERAGE SPECIFIC GRAVITY .488

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .0000 | .1000 | .0000 | 23 000 | .1133 | .1985 | .1059 |
| 1 000 | .0397 | .1255 | .0326 | 24 000 | .1180 | .2030 | .1105 |
| 2 000 | .0522 | .1325 | .0423 | 25 000 | .1234 | .2080 | .1157 |
| 3 000 | .0606 | .1375 | .0490 | 26 000 | .1297 | .2140 | .1218 |
| 4 000 | .0660 | .1420 | .0540 | 27 000 | .1370 | .2210 | .1290 |
| 5 000 | .0700 | .1460 | .0580 | 28 000 | .1452 | .2285 | .1368 |
| 6 000 | .0725 | .1490 | .0607 | 29 000 | .1536 | .2370 | .1453 |
| 7 000 | .0752 | .1525 | .0638 | 30 000 | .1638 | .2460 | .1549 |
| 8 000 | .0773 | .1550 | .0661 | 31 000 | .1748 | .2560 | .1654 |
| 9 000 | .0793 | .1575 | .0684 | 32 000 | .1858 | .2665 | .1761 |
| 10 000 | .0812 | .1600 | .0706 | 33 000 | .1992 | .2800 | .1896 |
| 11 000 | .0831 | .1625 | .0728 | 34 000 | .2112 | .2920 | .2016 |
| 12 000 | .0850 | .1650 | .0750 | 35 000 | .2280 | .3070 | .2175 |
| 13 000 | .0869 | .1680 | .0774 | 36 000 | .2450 | .3235 | .2342 |
| 14 000 | .0887 | .1705 | .0796 | 37 000 | .2642 | .3360 | .2501 |
| 15 000 | .0903 | .1735 | .0819 | 38 000 | .2840 | .3620 | .2730 |
| 16 000 | .0924 | .1760 | .0842 | 38 650 | .3065 | .3820 | .2942 |
| 17 000 | .0948 | .1790 | .0869 | | | | |
| 18 000 | .0972 | .1820 | .0896 | | | | |
| 19 000 | .0997 | .1850 | .0923 | | | | |
| 20 000 | .1027 | .1880 | .0953 | | | | |
| 21 000 | .1060 | .1910 | .0985 | | | | |
| 22 000 | .1093 | .1945 | .1019 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on both bolt lines.
 Piece 2 failed on right bolt line.
 Piece 3 failed on left bolt line and failed very slightly on
 right bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-13 DATE OF TEST: Sept. 18, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 10:48 a.m. END 10:56 a.m.
 AVERAGE MOISTURE CONTENT 8.8% AVERAGE SPECIFIC GRAVITY .444

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .1874 | .2200 | .1037 |
| 1 000 | .1176 | .1320 | .0248 | 24 000 | .1931 | .2270 | .1100 |
| 2 000 | .1233 | .1475 | .0354 | 25 000 | .1997 | .2330 | .1163 |
| 3 000 | .1270 | .1570 | .0420 | 26 000 | .2068 | .2400 | .1234 |
| 4 000 | .1300 | .1620 | .0460 | 27 000 | .2153 | .2480 | .1316 |
| 5 000 | .1329 | .1660 | .0494 | 28 000 | .2251 | .2575 | .1413 |
| 6 000 | .1353 | .1695 | .0524 | 29 000 | .2352 | .2670 | .1511 |
| 7 000 | .1380 | .1730 | .0555 | 30 000 | .2451 | .2770 | .1610 |
| 8 000 | .1406 | .1755 | .0580 | 31 000 | .2552 | .2870 | .1711 |
| 9 000 | .1430 | .1780 | .0605 | 32 000 | .2670 | .2990 | .1830 |
| 10 000 | .1453 | .1810 | .0632 | 33 000 | .2790 | .3115 | .1952 |
| 11 000 | .1479 | .1835 | .0657 | 34 000 | .2914 | .3240 | .2077 |
| 12 000 | .1504 | .1860 | .0682 | 35 000 | .3038 | .3370 | .2204 |
| 13 000 | .1530 | .1885 | .0707 | 36 000 | .3160 | .3500 | .2330 |
| 14 000 | .1557 | .1915 | .0736 | 37 000 | .3307 | .3655 | .2481 |
| 15 000 | .1582 | .1940 | .0761 | 38 000 | .3464 | .3820 | .2642 |
| 16 000 | .1613 | .1970 | .0791 | 39 000 | .3652 | .4020 | .2836 |
| 17 000 | .1645 | .2000 | .0822 | 39 550 | .3775 | .4140 | .2957 |
| 18 000 | .1676 | .2035 | .0855 | 40 000 | .3970 | .4340 | .3155 |
| 19 000 | .1712 | .2070 | .0891 | 40 800 | .4170 | .4580 | .3375 |
| 20 000 | .1750 | .2105 | .0927 | 41 000 | .4630 | .5020 | .3825 |
| 21 000 | .1785 | .2145 | .0965 | | | | |
| 22 000 | .1829 | .2180 | .1004 | | | | |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on left bolt line and failed very slightly on right bolt line.
 Piece 2 failed on right bolt line.
 Piece 3 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-14 DATE OF TEST: Sept. 18, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:09 a.m. END 11:17 a.m.
 AVERAGE MOISTURE CONTENT 8.5% AVERAGE SPECIFIC GRAVITY .503

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .1000 | .1000 | .0000 | 23 000 | .1942 | .2575 | .1258 |
| 1 000 | .1120 | .1330 | .0225 | 24 000 | .2016 | .2650 | .1333 |
| 2 000 | .1160 | .1520 | .0340 | 25 000 | .2083 | .2720 | .1401 |
| 3 000 | .1178 | .1660 | .0419 | 26 000 | .2157 | .2795 | .1476 |
| 4 000 | .1203 | .1740 | .0471 | 27 000 | .2234 | .2870 | .1552 |
| 5 000 | .1226 | .1790 | .0508 | 28 000 | .2313 | .2950 | .1631 |
| 6 000 | .1249 | .1835 | .0542 | 29 000 | .2388 | .3025 | .1706 |
| 7 000 | .1272 | .1890 | .0581 | 30 000 | .2470 | .3105 | .1787 |
| 8 000 | .1298 | .1920 | .0609 | 31 000 | .2556 | .3185 | .1870 |
| 9 000 | .1325 | .1955 | .0640 | 32 000 | .2650 | .3275 | .1962 |
| 10 000 | .1351 | .1990 | .0670 | 33 000 | .2750 | .3370 | .2060 |
| 11 000 | .1382 | .2025 | .0703 | 34 000 | .2853 | .3465 | .2159 |
| 12 000 | .1413 | .2060 | .0736 | 35 000 | .2960 | .3565 | .2262 |
| 13 000 | .1442 | .2095 | .0768 | 36 000 | .3068 | .3670 | .2369 |
| 14 000 | .1474 | .2125 | .0799 | 37 000 | .3188 | .3785 | .2486 |
| 15 000 | .1510 | .2165 | .0837 | 38 000 | .3330 | .3915 | .2622 |
| 16 000 | .1550 | .2205 | .0877 | 38 900 | .3490 | .4130 | .2810 |
| 17 000 | .1602 | .2250 | .0926 | 39 000 | .3575 | .4260 | .2917 |
| 18 000 | .1655 | .2295 | .0975 | 40 000 | .3773 | .4320 | .3046 |
| 19 000 | .1708 | .2345 | .1026 | 41 000 | .3992 | .4525 | .3258 |
| 20 000 | .1756 | .2395 | .1075 | 42 000 | .4230 | .4760 | .3495 |
| 21 000 | .1818 | .2450 | .1134 | 42 500 | .4375 | .4900 | .3637 |
| 22 000 | .1878 | .2515 | .1196 | | | | |

REMARKS: No dial jumping or cracking noise.
 Pieces 1 and 3 failed on both bolt lines.
 Piece 2 failed on left bolt line.

UNIVERSITY OF ALBERTA

DEPARTMENT OF CIVIL ENGINEERING

BOLTED JOINT TESTS

JOINT NO: D-15 DATE OF TEST: Sept. 18, 1959
 RATE OF LOADING 5,000 LB./MIN. TIME: BEGIN 11:25 a.m. END 11:35 a.m.
 AVERAGE MOISTURE CONTENT 9.1% AVERAGE SPECIFIC GRAVITY .490

| LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. | LOAD
LB. | LEFT
DIAL
IN. | RIGHT
DIAL
IN. | AVE.
DEFLN.
IN. |
|-------------|---------------------|----------------------|-----------------------|-------------|---------------------|----------------------|-----------------------|
| 0 | .2000 | .1000 | .0000 | 23 000 | .3141 | .1910 | .1025 |
| 1 000 | .2367 | .1200 | .0283 | 24 000 | .3197 | .1975 | .1086 |
| 2 000 | .2479 | .1245 | .0362 | 25 000 | .3260 | .2040 | .1150 |
| 3 000 | .2550 | .1275 | .0412 | 26 000 | .3335 | .2110 | .1222 |
| 4 000 | .2596 | .1305 | .0450 | 27 000 | .3408 | .2190 | .1299 |
| 5 000 | .2637 | .1335 | .0486 | 28 000 | .3490 | .2280 | .1385 |
| 6 000 | .2665 | .1360 | .0512 | 29 000 | .3580 | .2370 | .1475 |
| 7 000 | .2696 | .1390 | .0543 | 30 000 | .3669 | .2460 | .1564 |
| 8 000 | .2725 | .1415 | .0570 | 31 000 | .3762 | .2550 | .1656 |
| 9 000 | .2751 | .1440 | .0595 | 32 000 | .3870 | .2655 | .1762 |
| 10 000 | .2774 | .1465 | .0619 | 33 000 | .3981 | .2765 | .1873 |
| 11 000 | .2800 | .1490 | .0645 | 34 000 | .4104 | .2880 | .1992 |
| 12 000 | .2823 | .1515 | .0669 | 35 000 | .4243 | .3025 | .2134 |
| 13 000 | .2848 | .1535 | .0691 | 36 000 | .4404 | .3190 | .2297 |
| 14 000 | .2867 | .1560 | .0713 | 36 150 | .4440 | .3220 | .2330 |
| 15 000 | .2890 | .1590 | .0740 | 37 000 | .4600 | .3390 | .2495 |
| 16 000 | .2911 | .1615 | .0763 | 38 000 | .4820 | .3630 | .2725 |
| 17 000 | .2938 | .1645 | .0791 | 39 000 | .5050 | .3870 | .2960 |
| 18 000 | .2962 | .1680 | .0821 | 40 000 | .5250 | .4080 | .3165 |
| 19 000 | .2990 | .1720 | .0855 | 41 000 | ..... | ..... | ..... |
| 20 000 | .3022 | .1760 | .0891 | 42 000 | .5660 | .4510 | .3585 |
| 21 000 | .3056 | .1810 | .0933 | 43 000 | .5870 | .4710 | .3790 |
| 22 000 | .3093 | .1860 | .0976 | 43 550 | .6030 | .4870 | .3950 |

REMARKS: No dial jumping or cracking noise.
 Piece 1 failed on left bolt line and failed moderately on right
 bolt line.
 Piece 2 failed on right bolt line.
 Piece 3 failed on both bolt lines.

Journal of the Proceedings

of the General Assembly of the Presbyterian Church in the United States of America

held at the City of New York, in the year 1852

| First Session, 1852, from May 1st to May 15th | | | | Second Session, 1852, from May 15th to May 25th | | | |
|---|-------|------|-----------------------------|---|-------|------|-----------------------------|
| Day | Month | Year | Topic | Day | Month | Year | Topic |
| 1st | May | 1852 | Opening of the Session | 16th | May | 1852 | Continuation of the Session |
| 2nd | May | 1852 | Continuation of the Session | 17th | May | 1852 | Continuation of the Session |
| 3rd | May | 1852 | Continuation of the Session | 18th | May | 1852 | Continuation of the Session |
| 4th | May | 1852 | Continuation of the Session | 19th | May | 1852 | Continuation of the Session |
| 5th | May | 1852 | Continuation of the Session | 20th | May | 1852 | Continuation of the Session |
| 6th | May | 1852 | Continuation of the Session | 21st | May | 1852 | Continuation of the Session |
| 7th | May | 1852 | Continuation of the Session | 22nd | May | 1852 | Continuation of the Session |
| 8th | May | 1852 | Continuation of the Session | 23rd | May | 1852 | Continuation of the Session |
| 9th | May | 1852 | Continuation of the Session | 24th | May | 1852 | Continuation of the Session |
| 10th | May | 1852 | Continuation of the Session | 25th | May | 1852 | Closing of the Session |

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1852

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-1DATE TESTED: August 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 43.34 | 63.80 | 42.52 |
| DRY WEIGHT | 39.14 | 57.62 | 38.35 |
| WEIGHT OF WATER | 4.20 | 6.18 | 4.17 |
| MOISTURE CONTENT (%) | 10.7 | 10.7 | 10.9 |

AVERAGE MOISTURE CONTENT: 10.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 42.93 | 59.75 | 41.60 |
| DRY WEIGHT | | 39.14 | 57.62 | 38.35 |
| WEIGHT OF PARAFFIN | | 3.79 | 2.13 | 3.25 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 87 | 98 | 87 |
| | 2 | 89 | 101 | 87 |
| | 3 | 89 | 98 | 87 |
| | SUM | 265 | 297 | |
| | AVERAGE | 88.3 | 99.0 | 87.0 |
| *VOLUME OF PARAFFIN | | 4.3 | 2.4 | 3.6 |
| VOLUME OF SAMPLE | | 84.0 | 96.6 | 83.4 |
| SPECIFIC GRAVITY | | .466 | .596 | .460 |

AVERAGE SPECIFIC GRAVITY: .507*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THE UNIVERSITY OF CHICAGO

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1000 North Dearborn Avenue, Chicago, Illinois 60607

| Author | Title | Year | Notes |
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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-2 DATE TESTED: August 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 28.50 | 49.34 | 39.30 |
| DRY WEIGHT | 25.45 | 43.51 | 35.20 |
| WEIGHT OF WATER | 3.05 | 5.83 | 4.10 |
| MOISTURE CONTENT (%) | 12.0 | 13.4 | 11.6 |

AVERAGE MOISTURE CONTENT: 12.3%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 29.75 | 46.54 | 38.83 |
| DRY WEIGHT | | 25.45 | 43.51 | 35.20 |
| WEIGHT OF PARAFFIN | | 4.30 | 3.03 | 3.63 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 63 | 91 | 86 |
| | 2 | 65 | 91 | 86 |
| | NUMBER 3 | 65 | 91 | 87 |
| | SUM | 193 | | 259 |
| | AVERAGE | 64.3 | 91.0 | 86.3 |
| *VOLUME OF PARAFFIN | | 4.8 | 3.4 | 4.1 |
| VOLUME OF SAMPLE | | 59.5 | 87.6 | 82.2 |
| SPECIFIC GRAVITY | | .428 | .497 | .428 |

AVERAGE SPECIFIC GRAVITY: .451

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

ALPHABETIC LIST OF NAMES

Names are listed in alphabetical order of the last name.

| First Name | Last Name | Address | City |
|------------|-----------|-------------|---------------|
| John | Smith | 123 Main St | New York |
| James | Johnson | 456 Elm St | Los Angeles |
| Robert | Williams | 789 Oak St | Chicago |
| William | Brown | 101 Pine St | San Francisco |

Continued on next page

| | | | |
|---------|----------|----------------|---------------|
| John | Smith | 123 Main St | New York |
| James | Johnson | 456 Elm St | Los Angeles |
| Robert | Williams | 789 Oak St | Chicago |
| William | Brown | 101 Pine St | San Francisco |
| Richard | Davis | 202 Cedar St | Philadelphia |
| Thomas | Miller | 303 Birch St | Boston |
| Charles | Wilson | 404 Spruce St | Seattle |
| Henry | Moore | 505 Ash St | Portland |
| George | Taylor | 606 Hickory St | San Diego |
| Frank | Anderson | 707 Walnut St | Denver |
| Raymond | Clark | 808 Maple St | San Jose |

Continued on next page

Names are listed in alphabetical order of the last name.

Names are listed in alphabetical order of the last name.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-3DATE TESTED: August 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 42.09 | 52.88 | 48.60 |
| DRY WEIGHT | 38.02 | 47.18 | 43.79 |
| WEIGHT OF WATER | 4.07 | 5.70 | 4.81 |
| MOISTURE CONTENT (%) | 10.7 | 12.1 | 11.0 |

AVERAGE MOISTURE CONTENT: 11.3

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 40.89 | 49.20 | 47.23 |
| DRY WEIGHT | | 38.02 | 47.18 | 43.79 |
| WEIGHT OF PARAFFIN | | 2.87 | 2.02 | 3.44 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 82 | 78 | 95 |
| | 2 | 82 | 79 | 96 |
| | 3 | 82 | 78 | 97 |
| | SUM | | 235 | 288 |
| | AVERAGE | 82.0 | 78.3 | 96.0 |
| *VOLUME OF PARAFFIN | | 3.2 | 2.3 | 3.9 |
| VOLUME OF SAMPLE | | 78.8 | 76.0 | 92.1 |
| SPECIFIC GRAVITY | | .483 | .621 | .475 |

AVERAGE SPECIFIC GRAVITY: .526*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

Journal of the ...

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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-4 DATE TESTED: August 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 41.99 | 57.23 | 40.08 |
| DRY WEIGHT | 37.98 | 51.10 | 36.62 |
| WEIGHT OF WATER | 4.01 | 6.13 | 3.46 |
| MOISTURE CONTENT (%) | 10.5 | 12.0 | 9.5 |

AVERAGE MOISTURE CONTENT: 10.7%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 41.05 | 53.28 | 39.60 |
| DRY WEIGHT | | 37.98 | 51.10 | 36.62 |
| WEIGHT OF PARAFFIN | | 3.07 | 2.18 | 2.98 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 88 | 85 | 79 |
| | 2 | 88 | 86 | 80 |
| | 3 | 88 | 85 | 80 |
| | SUM | | 256 | 239 |
| | AVERAGE | 88.0 | 85.3 | 79.7 |
| *VOLUME OF PARAFFIN | | 3.4 | 2.4 | 3.3 |
| VOLUME OF SAMPLE | | 84.6 | 82.9 | 76.4 |
| SPECIFIC GRAVITY | | .449 | .617 | .480 |

AVERAGE SPECIFIC GRAVITY: .515

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE 1. - SUMMARY OF DATA FOR THE 1950-1951 FLOODING OF THE MISSISSIPPI RIVER AT ST. LOUIS, MISSOURI

UNITED STATES DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION

| DATE | STAGE, FEET | DISCHARGE, CFS | REMARKS |
|------|-------------|----------------|---------|
| 10.1 | 10.1 | 10.1 | 10.1 |
| 10.2 | 10.2 | 10.2 | 10.2 |
| 10.3 | 10.3 | 10.3 | 10.3 |
| 10.4 | 10.4 | 10.4 | 10.4 |

10.5 10.5 10.5 10.5

| | | | |
|------|------|------|------|
| 10.6 | 10.6 | 10.6 | 10.6 |
| 10.7 | 10.7 | 10.7 | 10.7 |
| 10.8 | 10.8 | 10.8 | 10.8 |
| 10.9 | 10.9 | 10.9 | 10.9 |
| 11.0 | 11.0 | 11.0 | 11.0 |
| 11.1 | 11.1 | 11.1 | 11.1 |
| 11.2 | 11.2 | 11.2 | 11.2 |
| 11.3 | 11.3 | 11.3 | 11.3 |
| 11.4 | 11.4 | 11.4 | 11.4 |
| 11.5 | 11.5 | 11.5 | 11.5 |
| 11.6 | 11.6 | 11.6 | 11.6 |
| 11.7 | 11.7 | 11.7 | 11.7 |
| 11.8 | 11.8 | 11.8 | 11.8 |
| 11.9 | 11.9 | 11.9 | 11.9 |
| 12.0 | 12.0 | 12.0 | 12.0 |

12.1 12.1 12.1 12.1

12.2 12.2 12.2 12.2

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-5 DATE TESTED: August 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 46.07 | 60.46 | 46.00 |
| DRY WEIGHT | 41.66 | 53.89 | 41.57 |
| WEIGHT OF WATER | 4.41 | 6.57 | 4.43 |
| MOISTURE CONTENT (%) | 10.6 | 12.2 | 10.6 |

AVERAGE MOISTURE CONTENT: 11.1%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 45.05 | 56.62 | 45.88 |
| DRY WEIGHT | | 41.66 | 53.89 | 41.57 |
| WEIGHT OF PARAFFIN | | 3.39 | 2.73 | 4.31 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 95 | 93 | 91 |
| | 2 | 93 | 93 | 91 |
| | 3 | 93 | 93 | 91 |
| | SUM | 281 | | |
| | AVERAGE | 93.7 | 93.0 | 91.0 |
| *VOLUME OF PARAFFIN | | 3.8 | 3.1 | 4.8 |
| VOLUME OF SAMPLE | | 89.9 | 89.9 | 86.2 |
| SPECIFIC GRAVITY | | .464 | .600 | .483 |

AVERAGE SPECIFIC GRAVITY: .516

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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| NAME | ADDRESS | CITY | STATE |
|------------------|--------------|---------|-------|
| JOHN D. SMITH | 1234 N. LAKE | CHICAGO | ILL. |
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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-6 DATE TESTED: August 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 34.47 | 53.73 | 36.31 |
| DRY WEIGHT | 30.57 | 46.38 | 32.20 |
| WEIGHT OF WATER | 3.90 | 7.35 | 4.11 |
| MOISTURE CONTENT (%) | 12.8 | 15.8 | 12.8 |

AVERAGE MOISTURE CONTENT: 13.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 34.58 | 49.96 | 35.62 |
| DRY WEIGHT | | 30.57 | 46.38 | 32.20 |
| WEIGHT OF PARAFFIN | | 4.01 | 3.58 | 3.42 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 71 | 93 | 75 |
| | 2 | 73 | 93 | 76 |
| | 3 | 73 | 93 | 76 |
| | SUM | 217 | | 227 |
| | AVERAGE | 72.3 | 93.0 | 75.7 |
| *VOLUME OF PARAFFIN | | 4.5 | 4.0 | 3.8 |
| VOLUME OF SAMPLE | | 67.8 | 89.0 | 71.9 |
| SPECIFIC GRAVITY | | .450 | .522 | .448 |

AVERAGE SPECIFIC GRAVITY: .473

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE 1. - SUMMARY OF DATA FOR THE 1950-1951 FISHING SEASON

Source: U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Office of Statistics

| 1950-1951 | | | |
|-----------|---------|----------|-----------|
| Month | Species | Quantity | Value |
| Jan. | Salmon | 100,000 | \$100,000 |
| Feb. | Salmon | 120,000 | \$120,000 |
| Mar. | Salmon | 150,000 | \$150,000 |
| Apr. | Salmon | 180,000 | \$180,000 |

TABLE 2. - SUMMARY OF DATA FOR THE 1951-1952 FISHING SEASON

| 1951-1952 | | | |
|-----------|---------|----------|-----------|
| Month | Species | Quantity | Value |
| Jan. | Salmon | 110,000 | \$110,000 |
| Feb. | Salmon | 130,000 | \$130,000 |
| Mar. | Salmon | 160,000 | \$160,000 |
| Apr. | Salmon | 190,000 | \$190,000 |
| May | Salmon | 220,000 | \$220,000 |
| Jun. | Salmon | 250,000 | \$250,000 |
| Jul. | Salmon | 280,000 | \$280,000 |
| Aug. | Salmon | 310,000 | \$310,000 |
| Sep. | Salmon | 340,000 | \$340,000 |
| Oct. | Salmon | 370,000 | \$370,000 |
| Nov. | Salmon | 400,000 | \$400,000 |
| Dec. | Salmon | 430,000 | \$430,000 |

TABLE 3. - SUMMARY OF DATA FOR THE 1952-1953 FISHING SEASON

Source: U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Office of Statistics

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-7 DATE TESTED: August 19, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 56.95 | 43.98 | 32.06 |
| DRY WEIGHT | 51.02 | 39.24 | 28.64 |
| WEIGHT OF WATER | 5.93 | 4.74 | 3.42 |
| MOISTURE CONTENT (%) | 11.6 | 11.8 | 11.9 |

AVERAGE MOISTURE CONTENT: 11.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 52.41 | 41.27 | 31.88 |
| DRY WEIGHT | | 51.02 | 39.24 | 28.64 |
| WEIGHT OF PARAFFIN | | 1.39 | 2.03 | 3.24 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 85 | 80 | 65 |
| | 2 | 85 | 80 | 67 |
| | 3 | 85 | 80 | 68 |
| | SUM | | | 200 |
| | AVERAGE | 85.0 | 80.0 | 66.7 |
| *VOLUME OF PARAFFIN | | 1.6 | 2.3 | 3.6 |
| VOLUME OF SAMPLE | | 83.4 | 77.7 | 63.1 |
| SPECIFIC GRAVITY | | .612 | .505 | .454 |

AVERAGE SPECIFIC GRAVITY: .517

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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| 45. Appendix AK | 46. Appendix AL | 47. Appendix AM | 48. Appendix AN |
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University of Alberta
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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-8 DATE TESTED: August 19, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 32.63 | 54.30 | 32.53 |
| DRY WEIGHT | 29.15 | 48.42 | 29.15 |
| WEIGHT OF WATER | 3.48 | 5.88 | 3.38 |
| MOISTURE CONTENT (%) | 11.9 | 12.2 | 11.6 |

AVERAGE MOISTURE CONTENT: 11.9%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 32.68 | 50.89 | 32.82 |
| DRY WEIGHT | | 29.15 | 48.42 | 29.15 |
| WEIGHT OF PARAFFIN | | 3.53 | 2.47 | 3.67 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 65 | 99 | 69 |
| | 2 | 66 | 99 | 70 |
| | 3 | 67 | 99 | 70 |
| | SUM | 198 | | 209 |
| | AVERAGE | 66.0 | 99.0 | 69.7 |
| *VOLUME OF PARAFFIN | | 4.0 | 2.8 | 4.1 |
| VOLUME OF SAMPLE | | 62.0 | 96.2 | 65.6 |
| SPECIFIC GRAVITY | | 0.470 | 0.503 | 0.444 |

AVERAGE SPECIFIC GRAVITY: 0.472

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-9DATE TESTED: August 19, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 64.78 | 54.60 | 51.44 |
| DRY WEIGHT | 57.52 | 48.52 | 45.94 |
| WEIGHT OF WATER | 7.26 | 6.08 | 5.50 |
| MOISTURE CONTENT (%) | 12.6 | 12.5 | 12.0 |

AVERAGE MOISTURE CONTENT: 12.4%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 58.90 | 51.40 | 47.36 |
| DRY WEIGHT | | 57.52 | 48.52 | 45.94 |
| WEIGHT OF PARAFFIN | | 1.38 | 2.88 | 1.42 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 88 | 104 | 75 |
| | 2 | 88 | 104 | 75 |
| | 3 | 88 | 104 | 75 |
| | SUM | | | |
| | AVERAGE | 88.0 | 104.0 | 75.0 |
| *VOLUME OF PARAFFIN | | 1.5 | 3.2 | 1.6 |
| VOLUME OF SAMPLE | | 86.5 | 100.8 | 73.4 |
| SPECIFIC GRAVITY | | 0.665 | 0.481 | 0.626 |

AVERAGE SPECIFIC GRAVITY: 0.591*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS ³

TABLE I
Summary of the results of the experiments

Experiments were conducted under the following conditions:
Temperature: 25°C
pH: 7.0
Concentration of reactants: 0.1 M

| Time (min) | Concentration (M) | Rate of reaction (M/min) | Order of reaction |
|------------|-------------------|--------------------------|-------------------|
| 0 | 0.100 | 0.000 | |
| 10 | 0.090 | 0.001 | |
| 20 | 0.081 | 0.002 | |
| 30 | 0.073 | 0.003 | |
| 40 | 0.066 | 0.004 | |

From the above data, the order of reaction was determined to be 1.0.

| Time (min) | Concentration (M) | Rate of reaction (M/min) | Order of reaction |
|------------|-------------------|--------------------------|-------------------|
| 0 | 0.100 | 0.000 | |
| 10 | 0.090 | 0.001 | |
| 20 | 0.081 | 0.002 | |
| 30 | 0.073 | 0.003 | |
| 40 | 0.066 | 0.004 | |
| 50 | 0.060 | 0.005 | |
| 60 | 0.054 | 0.006 | |
| 70 | 0.049 | 0.007 | |
| 80 | 0.045 | 0.008 | |
| 90 | 0.041 | 0.009 | |
| 100 | 0.037 | 0.010 | |

The rate of reaction was found to be directly proportional to the concentration of the reactants.

Therefore, the reaction is first order with respect to the reactants.

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-10 DATE TESTED: August 19, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 35.65 | 64.41 | 34.80 |
| DRY WEIGHT | 31.69 | 56.64 | 30.91 |
| WEIGHT OF WATER | 3.96 | 7.77 | 3.89 |
| MOISTURE CONTENT (%) | 12.5 | 13.7 | 12.6 |

AVERAGE MOISTURE CONTENT: 12.9%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 35.62 | 59.70 | 34.56 |
| DRY WEIGHT | | 31.69 | 56.64 | 30.91 |
| WEIGHT OF PARAFFIN | | 3.93 | 3.06 | 3.65 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 76 | 111 | 72 |
| | 2 | 75 | 111 | 72 |
| | 3 | 75 | 111 | 72 |
| | SUM | 226 | | |
| | AVERAGE | 75.3 | 111.0 | 72.0 |
| *VOLUME OF PARAFFIN | | 4.4 | 3.4 | 4.1 |
| VOLUME OF SAMPLE | | 70.9 | 107.6 | 67.9 |
| SPECIFIC GRAVITY | | 0.447 | 0.527 | 0.455 |

AVERAGE SPECIFIC GRAVITY: 0.476

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

Algebra for the use of
Students of the University of Chicago

First Year Course

Prepared by the Faculty of the University of Chicago

Second Edition

Revised Edition

1915

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-11 DATE TESTED: August 19, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 69.63 | 54.45 | 48.75 |
| DRY WEIGHT | 61.89 | 47.93 | 43.43 |
| WEIGHT OF WATER | 7.74 | 6.52 | 5.32 |
| MOISTURE CONTENT (%) | 12.5 | 13.6 | 12.3 |

AVERAGE MOISTURE CONTENT: 12.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 63.55 | 50.80 | 45.05 |
| DRY WEIGHT | | 61.89 | 47.93 | 43.43 |
| WEIGHT OF PARAFFIN | | 1.66 | 2.87 | 1.62 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 84 | 96 | 66 |
| | 2 | 86 | 96 | 67 |
| | 3 | 85 | 96 | 66 |
| | SUM | | | 199 |
| | AVERAGE | 85.0 | 96.0 | 66.3 |
| *VOLUME OF PARAFFIN | | 1.9 | 3.2 | 1.8 |
| VOLUME OF SAMPLE | | 83.1 | 92.8 | 64.5 |
| SPECIFIC GRAVITY | | 0.745 | 0.516 | 0.673 |

AVERAGE SPECIFIC GRAVITY: 0.645

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-12 DATE TESTED: August 19, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 45.97 | 71.86 | 44.46 |
| DRY WEIGHT | 41.20 | 63.68 | 40.09 |
| WEIGHT OF WATER | 4.77 | 8.18 | 4.37 |
| MOISTURE CONTENT (%) | 11.6 | 12.8 | 10.9 |

AVERAGE MOISTURE CONTENT: 11.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 44.48 | 65.42 | 42.87 |
| DRY WEIGHT | | 41.20 | 63.68 | 40.09 |
| WEIGHT OF PARAFFIN | | 3.28 | 1.74 | 2.78 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 79 | 106 | 75 |
| | 2 | 78 | 105 | 75 |
| | 3 | 78 | 106 | 75 |
| | SUM | 235 | 317 | |
| | AVERAGE | 78.3 | 105.7 | 75.0 |
| *VOLUME OF PARAFFIN | | 3.7 | 2.0 | 3.1 |
| VOLUME OF SAMPLE | | 74.6 | 103.7 | 71.9 |
| SPECIFIC GRAVITY | | 0.552 | 0.615 | 0.558 |

AVERAGE SPECIFIC GRAVITY: 0.575

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE I

Summary of the results of the experiments conducted during the year 1900.

| Experiment No. | Time (min) | Temperature (°C) | Pressure (mm Hg) |
|----------------|------------|------------------|------------------|
| 1. | 10.20 | 15.0 | 760 |
| 2. | 10.40 | 15.5 | 760 |
| 3. | 10.60 | 16.0 | 760 |
| 4. | 10.80 | 16.5 | 760 |

Continued from page 101.

| | | | |
|------|-------|------|-----|
| 5. | 11.00 | 17.0 | 760 |
| 6. | 11.20 | 17.5 | 760 |
| 7. | 11.40 | 18.0 | 760 |
| 8. | 11.60 | 18.5 | 760 |
| 9. | 11.80 | 19.0 | 760 |
| 10. | 12.00 | 19.5 | 760 |
| 11. | 12.20 | 20.0 | 760 |
| 12. | 12.40 | 20.5 | 760 |
| 13. | 12.60 | 21.0 | 760 |
| 14. | 12.80 | 21.5 | 760 |
| 15. | 13.00 | 22.0 | 760 |
| 16. | 13.20 | 22.5 | 760 |
| 17. | 13.40 | 23.0 | 760 |
| 18. | 13.60 | 23.5 | 760 |
| 19. | 13.80 | 24.0 | 760 |
| 20. | 14.00 | 24.5 | 760 |
| 21. | 14.20 | 25.0 | 760 |
| 22. | 14.40 | 25.5 | 760 |
| 23. | 14.60 | 26.0 | 760 |
| 24. | 14.80 | 26.5 | 760 |
| 25. | 15.00 | 27.0 | 760 |
| 26. | 15.20 | 27.5 | 760 |
| 27. | 15.40 | 28.0 | 760 |
| 28. | 15.60 | 28.5 | 760 |
| 29. | 15.80 | 29.0 | 760 |
| 30. | 16.00 | 29.5 | 760 |
| 31. | 16.20 | 30.0 | 760 |
| 32. | 16.40 | 30.5 | 760 |
| 33. | 16.60 | 31.0 | 760 |
| 34. | 16.80 | 31.5 | 760 |
| 35. | 17.00 | 32.0 | 760 |
| 36. | 17.20 | 32.5 | 760 |
| 37. | 17.40 | 33.0 | 760 |
| 38. | 17.60 | 33.5 | 760 |
| 39. | 17.80 | 34.0 | 760 |
| 40. | 18.00 | 34.5 | 760 |
| 41. | 18.20 | 35.0 | 760 |
| 42. | 18.40 | 35.5 | 760 |
| 43. | 18.60 | 36.0 | 760 |
| 44. | 18.80 | 36.5 | 760 |
| 45. | 19.00 | 37.0 | 760 |
| 46. | 19.20 | 37.5 | 760 |
| 47. | 19.40 | 38.0 | 760 |
| 48. | 19.60 | 38.5 | 760 |
| 49. | 19.80 | 39.0 | 760 |
| 50. | 20.00 | 39.5 | 760 |
| 51. | 20.20 | 40.0 | 760 |
| 52. | 20.40 | 40.5 | 760 |
| 53. | 20.60 | 41.0 | 760 |
| 54. | 20.80 | 41.5 | 760 |
| 55. | 21.00 | 42.0 | 760 |
| 56. | 21.20 | 42.5 | 760 |
| 57. | 21.40 | 43.0 | 760 |
| 58. | 21.60 | 43.5 | 760 |
| 59. | 21.80 | 44.0 | 760 |
| 60. | 22.00 | 44.5 | 760 |
| 61. | 22.20 | 45.0 | 760 |
| 62. | 22.40 | 45.5 | 760 |
| 63. | 22.60 | 46.0 | 760 |
| 64. | 22.80 | 46.5 | 760 |
| 65. | 23.00 | 47.0 | 760 |
| 66. | 23.20 | 47.5 | 760 |
| 67. | 23.40 | 48.0 | 760 |
| 68. | 23.60 | 48.5 | 760 |
| 69. | 23.80 | 49.0 | 760 |
| 70. | 24.00 | 49.5 | 760 |
| 71. | 24.20 | 50.0 | 760 |
| 72. | 24.40 | 50.5 | 760 |
| 73. | 24.60 | 51.0 | 760 |
| 74. | 24.80 | 51.5 | 760 |
| 75. | 25.00 | 52.0 | 760 |
| 76. | 25.20 | 52.5 | 760 |
| 77. | 25.40 | 53.0 | 760 |
| 78. | 25.60 | 53.5 | 760 |
| 79. | 25.80 | 54.0 | 760 |
| 80. | 26.00 | 54.5 | 760 |
| 81. | 26.20 | 55.0 | 760 |
| 82. | 26.40 | 55.5 | 760 |
| 83. | 26.60 | 56.0 | 760 |
| 84. | 26.80 | 56.5 | 760 |
| 85. | 27.00 | 57.0 | 760 |
| 86. | 27.20 | 57.5 | 760 |
| 87. | 27.40 | 58.0 | 760 |
| 88. | 27.60 | 58.5 | 760 |
| 89. | 27.80 | 59.0 | 760 |
| 90. | 28.00 | 59.5 | 760 |
| 91. | 28.20 | 60.0 | 760 |
| 92. | 28.40 | 60.5 | 760 |
| 93. | 28.60 | 61.0 | 760 |
| 94. | 28.80 | 61.5 | 760 |
| 95. | 29.00 | 62.0 | 760 |
| 96. | 29.20 | 62.5 | 760 |
| 97. | 29.40 | 63.0 | 760 |
| 98. | 29.60 | 63.5 | 760 |
| 99. | 29.80 | 64.0 | 760 |
| 100. | 30.00 | 64.5 | 760 |

Continued from page 101.

Summary of the results of the experiments conducted during the year 1900.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-13 DATE TESTED: August 24, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 39.07 | 64.43 | 41.52 |
| DRY WEIGHT | 34.92 | 57.14 | 37.15 |
| WEIGHT OF WATER | 4.15 | 7.29 | 4.37 |
| MOISTURE CONTENT (%) | 11.9 | 12.7 | 11.8 |

AVERAGE MOISTURE CONTENT: 12.3%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 38.85 | 61.04 | 42.29 |
| DRY WEIGHT | | 34.92 | 57.14 | 37.15 |
| WEIGHT OF PARAFFIN | | 3.93 | 3.90 | 5.14 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 83 | 119 | 90 |
| | 2 | 83 | 119 | 90 |
| | 3 | 83 | 119 | 90 |
| | SUM | | | |
| | AVERAGE | 83.0 | 119.0 | 90.0 |
| *VOLUME OF PARAFFIN | | 4.4 | 4.4 | 5.8 |
| VOLUME OF SAMPLE | | 78.6 | 114.6 | 84.2 |
| SPECIFIC GRAVITY | | 0.444 | 0.499 | 0.441 |

AVERAGE SPECIFIC GRAVITY: 0.461

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-14 DATE TESTED: August 24, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 36.86 | 70.67 | 44.79 |
| DRY WEIGHT | 33.37 | 63.69 | 40.21 |
| WEIGHT OF WATER | 3.49 | 6.98 | 4.58 |
| MOISTURE CONTENT (%) | 10.5 | 11.0 | 11.4 |

AVERAGE MOISTURE CONTENT: 11.0%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 36.73 | 66.64 | 43.14 |
| DRY WEIGHT | | 33.37 | 63.69 | 40.21 |
| WEIGHT OF PARAFFIN | | 3.36 | 2.95 | 2.93 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 77 | 108 | 90 |
| | 2 | 78 | 108 | 91 |
| | 3 | 76 | 108 | 91 |
| | SUM | 231 | | 272 |
| | AVERAGE | 77.0 | 108.0 | 90.7 |
| *VOLUME OF PARAFFIN | | 3.8 | 3.3 | 3.3 |
| VOLUME OF SAMPLE | | 73.2 | 104.7 | 87.4 |
| SPECIFIC GRAVITY | | 0.455 | 0.609 | 0.460 |

AVERAGE SPECIFIC GRAVITY: 0.508

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: A-15 DATE TESTED: August 24, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 51.68 | 50.15 | 61.12 |
| DRY WEIGHT | 46.70 | 44.57 | 55.12 |
| WEIGHT OF WATER | 4.98 | 5.58 | 6.00 |
| MOISTURE CONTENT (%) | 10.7 | 12.5 | 10.9 |

AVERAGE MOISTURE CONTENT: 11.4%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 50.64 | 46.80 | 58.54 |
| DRY WEIGHT | | 46.70 | 44.57 | 55.12 |
| WEIGHT OF PARAFFIN | | 3.94 | 2.23 | 3.42 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 83 | 74 | 95 |
| | 2 | 84 | 75 | 95 |
| | 3 | 84 | 75 | 95 |
| | SUM | 251 | 224 | |
| | AVERAGE | 83.7 | 74.7 | 95.0 |
| *VOLUME OF PARAFFIN | | 4.4 | 2.5 | 3.8 |
| VOLUME OF SAMPLE | | 79.3 | 72.2 | 91.2 |
| SPECIFIC GRAVITY | | 0.589 | 0.618 | 0.604 |

AVERAGE SPECIFIC GRAVITY: 0.604

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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| 3. 10 | 3. 10 | 3. 10 | 3. 10 |
| 4. 10 | 4. 10 | 4. 10 | 4. 10 |

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| 3. 10 | 3. 10 | 3. 10 | 3. 10 |
| 4. 10 | 4. 10 | 4. 10 | 4. 10 |
| 5. 10 | 5. 10 | 5. 10 | 5. 10 |
| 6. 10 | 6. 10 | 6. 10 | 6. 10 |
| 7. 10 | 7. 10 | 7. 10 | 7. 10 |
| 8. 10 | 8. 10 | 8. 10 | 8. 10 |
| 9. 10 | 9. 10 | 9. 10 | 9. 10 |
| 10. 10 | 10. 10 | 10. 10 | 10. 10 |

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Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-1DATE TESTED: June 10, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 49.37 | 80.57 | 85.27 |
| DRY WEIGHT | 40.39 | 63.80 | 69.50 |
| WEIGHT OF WATER | 8.98 | 16.77 | 15.77 |
| MOISTURE CONTENT (%) | 22.2 | 26.3 | 22.7 |

AVERAGE MOISTURE CONTENT: 23.7%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 43.51 | 69.99 | 73.13 |
| DRY WEIGHT | | 40.39 | 63.80 | 69.50 |
| WEIGHT OF PARAFFIN | | 3.12 | 6.19 | 3.63 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 94 | 129 | 127 |
| | 2 | 95 | 130 | 128 |
| | 3 | 96 | 129 | 128 |
| | SUM | 285 | 388 | 383 |
| | AVERAGE | 95.0 | 129.3 | 127.7 |
| *VOLUME OF PARAFFIN | | 3.5 | 6.9 | 4.1 |
| VOLUME OF SAMPLE | | 91.5 | 122.4 | 123.6 |
| SPECIFIC GRAVITY | | .442 | .521 | .563 |

AVERAGE SPECIFIC GRAVITY: 0.509*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

Monthly Statement of Income and Expenses

For the month of _____

Prepared by _____

| Income | | | |
|-----------|--------|------------|-------|
| Source | Amount | Percentage | Notes |
| Salary | 10.00 | 100% | |
| Interest | 0.00 | 0% | |
| Dividends | 0.00 | 0% | |
| Gifts | 0.00 | 0% | |
| Other | 0.00 | 0% | |

Total Income: 10.00

| Expenses | | | |
|----------------|--------|------------|-------|
| Category | Amount | Percentage | Notes |
| Food | 2.00 | 20% | |
| Transportation | 1.00 | 10% | |
| Utilities | 1.00 | 10% | |
| Entertainment | 0.50 | 5% | |
| Health | 0.50 | 5% | |
| Insurance | 0.50 | 5% | |
| Education | 0.50 | 5% | |
| Other | 0.00 | 0% | |
| Total | 5.50 | 55% | |

Total Expenses: 5.50

Net Income: 4.50

Prepared by _____

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-2 DATE TESTED: June 10, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 63.12 | 65.71 | 54.76 |
| DRY WEIGHT | 51.42 | 51.32 | 44.25 |
| WEIGHT OF WATER | 11.70 | 14.39 | 10.51 |
| MOISTURE CONTENT (%) | 22.8 | 28.0 | 23.8 |

AVERAGE MOISTURE CONTENT: 24.9%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 55.76 | 56.63 | 48.04 |
| DRY WEIGHT | | 51.42 | 51.32 | 44.25 |
| WEIGHT OF PARAFFIN | | 4.34 | 5.31 | 3.79 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 119 | 104 | 102 |
| | 2 | 120 | 104 | 102 |
| | 3 | 119 | 103 | 102 |
| | SUM | 358 | 311 | 306 |
| | AVERAGE | 119.3 | 103.7 | 102.0 |
| *VOLUME OF PARAFFIN | | 4.9 | 5.9 | 4.2 |
| VOLUME OF SAMPLE | | 114.4 | 97.8 | 97.8 |
| SPECIFIC GRAVITY | | 0.448 | 0.525 | 0.453 |

AVERAGE SPECIFIC GRAVITY: 0.475

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-3 DATE TESTED: June 10, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 71.78 | 74.53 | 75.41 |
| DRY WEIGHT | 58.13 | 58.33 | 61.02 |
| WEIGHT OF WATER | 13.65 | 16.20 | 14.39 |
| MOISTURE CONTENT (%) | 23.5 | 27.8 | 23.6 |

AVERAGE MOISTURE CONTENT: 25.0%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 63.35 | 63.88 | 66.59 |
| DRY WEIGHT | | 58.13 | 58.33 | 61.02 |
| WEIGHT OF PARAFFIN | | 5.22 | 5.55 | 5.57 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 136 | 120 | 141 |
| | 2 | 138 | 120 | 141 |
| | 3 | 138 | 121 | 141 |
| | SUM | 412 | 361 | 423 |
| | AVERAGE | 137.3 | 120.3 | 141.0 |
| *VOLUME OF PARAFFIN | | 5.8 | 6.2 | 6.2 |
| VOLUME OF SAMPLE | | 131.5 | 114.1 | 134.8 |
| SPECIFIC GRAVITY | | 0.442 | 0.510 | 0.453 |

AVERAGE SPECIFIC GRAVITY: 0.468

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-4 DATE TESTED: July 28, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 56.87 | 77.58 | 57.23 |
| DRY WEIGHT | 46.93 | 62.52 | 46.95 |
| WEIGHT OF WATER | 9.94 | 15.06 | 10.28 |
| MOISTURE CONTENT (%) | 21.2 | 24.1 | 21.9 |

AVERAGE MOISTURE CONTENT: 22.4%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 49.70 | 67.30 | 49.40 |
| DRY WEIGHT | | 46.93 | 62.52 | 46.95 |
| WEIGHT OF PARAFFIN | | 2.77 | 4.78 | 2.45 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 101 | 137 | 96 |
| | 2 | 101 | 138 | 96 |
| | 3 | 101 | 138 | 96 |
| | SUM | | 413 | |
| | AVERAGE | 101.0 | 137.7 | 96.0 |
| *VOLUME OF PARAFFIN | | 3.1 | 5.4 | 2.7 |
| VOLUME OF SAMPLE | | 97.9 | 132.3 | 93.3 |
| SPECIFIC GRAVITY | | 0.479 | 0.472 | 0.504 |

AVERAGE SPECIFIC GRAVITY: 0.485

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-5 DATE TESTED: July 28, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 47.39 | 75.15 | 42.98 |
| DRY WEIGHT | 38.77 | 60.71 | 35.39 |
| WEIGHT OF WATER | 8.62 | 14.44 | 7.59 |
| MOISTURE CONTENT (%) | 22.3 | 23.8 | 21.4 |

AVERAGE MOISTURE CONTENT: 22.5%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 41.34 | 65.38 | 38.58 |
| DRY WEIGHT | | 38.77 | 60.71 | 35.39 |
| WEIGHT OF PARAFFIN | | 2.57 | 4.67 | 3.19 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 82 | 134 | 86 |
| | 2 | 82 | 135 | 88 |
| | 3 | 82 | 134 | 87 |
| | SUM | | 403 | 261 |
| | AVERAGE | 82.0 | 134.3 | 87.0 |
| *VOLUME OF PARAFFIN | | 2.9 | 5.2 | 3.6 |
| VOLUME OF SAMPLE | | 79.1 | 129.1 | 83.4 |
| SPECIFIC GRAVITY | | 0.489 | 0.470 | 0.425 |

AVERAGE SPECIFIC GRAVITY: 0.461

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-6DATE TESTED: June 22, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 55.09 | 78.02 | 51.68 |
| DRY WEIGHT | 46.11 | 64.65 | 43.34 |
| WEIGHT OF WATER | 8.98 | 13.37 | 8.34 |
| MOISTURE CONTENT (%) | 19.5 | 20.6 | 19.2 |

AVERAGE MOISTURE CONTENT: 19.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 52.57 | 72.64 | 49.54 |
| DRY WEIGHT | | 46.11 | 64.65 | 43.34 |
| WEIGHT OF PARAFFIN | | 6.46 | 7.99 | 6.20 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 114 | 134 | 102 |
| | 2 | 114 | 135 | 102 |
| | 3 | 114 | 136 | 102 |
| | SUM | 342 | 405 | 306 |
| | AVERAGE | 114.0 | 135.0 | 102.0 |
| *VOLUME OF PARAFFIN | | 7.2 | 9.0 | 7.0 |
| VOLUME OF SAMPLE | | 106.8 | 126.0 | 95.0 |
| SPECIFIC GRAVITY | | 0.432 | 0.512 | 0.456 |

AVERAGE SPECIFIC GRAVITY: 0.467*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-7 DATE TESTED: June 22, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 56.43 | 86.56 | 59.24 |
| DRY WEIGHT | 46.83 | 72.92 | 49.66 |
| WEIGHT OF WATER | 9.60 | 13.64 | 9.58 |
| MOISTURE CONTENT (%) | 20.5 | 18.7 | 19.3 |

AVERAGE MOISTURE CONTENT: 19.5%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 53.37 | 80.91 | 56.45 |
| DRY WEIGHT | | 46.83 | 72.92 | 49.66 |
| WEIGHT OF PARAFFIN | | 6.54 | 7.99 | 6.79 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 111 | 147 | 122 |
| | 2 | 111 | 147 | 123 |
| | 3 | 111 | 147 | 123 |
| | SUM | 333 | 441 | 368 |
| | AVERAGE | 111.0 | 147.0 | 122.7 |
| *VOLUME OF PARAFFIN | | 7.3 | 9.0 | 7.6 |
| VOLUME OF SAMPLE | | 103.7 | 138.0 | 115.1 |
| SPECIFIC GRAVITY | | 0.452 | 0.528 | 0.431 |

AVERAGE SPECIFIC GRAVITY: 0.470

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-8 DATE TESTED: July 28, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 43.34 | 72.39 | 40.37 |
| DRY WEIGHT | 35.73 | 57.85 | 33.34 |
| WEIGHT OF WATER | 7.61 | 14.54 | 7.03 |
| MOISTURE CONTENT (%) | 21.3 | 25.2 | 21.1 |

AVERAGE MOISTURE CONTENT: 22.5%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 39.11 | 63.05 | 36.61 |
| DRY WEIGHT | | 35.73 | 57.85 | 33.34 |
| WEIGHT OF PARAFFIN | | 3.38 | 5.20 | 3.27 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 85 | 126 | 80 |
| | 2 | 86 | 126 | 80 |
| | 3 | 86 | 126 | 80 |
| | SUM | 257 | | |
| | AVERAGE | 85.7 | 126.0 | 80.0 |
| *VOLUME OF PARAFFIN | | 3.8 | 5.8 | 3.7 |
| VOLUME OF SAMPLE | | 81.9 | 120.2 | 76.3 |
| SPECIFIC GRAVITY | | 0.436 | 0.481 | 0.437 |

AVERAGE SPECIFIC GRAVITY: 0.451

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-9 DATE TESTED: July 28, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 53.43 | 70.04 | 70.92 |
| DRY WEIGHT | 44.21 | 56.93 | 59.41 |
| WEIGHT OF WATER | 9.22 | 13.11 | 11.51 |
| MOISTURE CONTENT (%) | 20.9 | 23.1 | 19.4 |

AVERAGE MOISTURE CONTENT: 21.1%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 46.90 | 61.06 | 61.93 |
| DRY WEIGHT | | 44.21 | 56.93 | 59.41 |
| WEIGHT OF PARAFFIN | | 2.69 | 4.13 | 2.52 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 92 | 121 | 114 |
| | 2 | 92 | 123 | 115 |
| | 3 | 92 | 123 | 115 |
| | SUM | | 367 | 344 |
| | AVERAGE | 92.0 | 122.3 | 114.7 |
| *VOLUME OF PARAFFIN | | 3.0 | 4.6 | 2.8 |
| VOLUME OF SAMPLE | | 89.0 | 117.7 | 111.9 |
| SPECIFIC GRAVITY | | 0.497 | 0.484 | 0.531 |

AVERAGE SPECIFIC GRAVITY: 0.504

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-10DATE TESTED: June 25, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 45.28 | 67.29 | 51.60 |
| DRY WEIGHT | 37.89 | 55.69 | 42.78 |
| WEIGHT OF WATER | 7.39 | 11.60 | 8.82 |
| MOISTURE CONTENT (%) | 19.5 | 20.8 | 20.6 |

AVERAGE MOISTURE CONTENT: 20.3%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 41.84 | 59.89 | 47.21 |
| DRY WEIGHT | | 37.89 | 55.69 | 42.78 |
| WEIGHT OF PARAFFIN | | 3.95 | 4.20 | 4.43 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 85 | 126 | 95 |
| | 2 | 85 | 128 | 97 |
| | 3 | 85 | 128 | 97 |
| | SUM | | 382 | 289 |
| | AVERAGE | 85.0 | 127.3 | 96.3 |
| *VOLUME OF PARAFFIN | | 4.4 | 4.7 | 5.0 |
| VOLUME OF SAMPLE | | 80.6 | 122.6 | 91.3 |
| SPECIFIC GRAVITY | | 0.470 | 0.455 | 0.469 |

AVERAGE SPECIFIC GRAVITY: 0.465*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-11 DATE TESTED: July 29, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 40.02 | 63.07 | 46.20 |
| DRY WEIGHT | 32.71 | 50.89 | 37.83 |
| WEIGHT OF WATER | 7.31 | 12.18 | 8.37 |
| MOISTURE CONTENT (%) | 22.4 | 23.9 | 22.1 |

AVERAGE MOISTURE CONTENT: 22.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 35.75 | 54.66 | 41.44 |
| DRY WEIGHT | | 32.71 | 50.89 | 37.83 |
| WEIGHT OF PARAFFIN | | 3.04 | 3.77 | 3.61 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 79 | 104 | 90 |
| | 2 | 79 | 105 | 89 |
| | 3 | 79 | 104 | 88 |
| | SUM | | 313 | 267 |
| | AVERAGE | 79.0 | 104.3 | 89.0 |
| *VOLUME OF PARAFFIN | | 3.4 | 4.2 | 4.0 |
| VOLUME OF SAMPLE | | 75.6 | 100.1 | 85.0 |
| SPECIFIC GRAVITY | | 0.433 | 0.508 | 0.445 |

AVERAGE SPECIFIC GRAVITY: 0.462

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

Table No. 1. Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction.

The results of the experiments are given in the following table. The rate of the reaction is expressed in terms of the amount of the substance which reacts in a given time.

| Concentration of the solution | Rate of the reaction | Time taken for the reaction to complete | Amount of the substance which reacts |
|-------------------------------|----------------------|---|--------------------------------------|
| 0.1 M | 0.05 | 10 min | 0.05 g |
| 0.2 M | 0.10 | 5 min | 0.10 g |
| 0.3 M | 0.15 | 3 min | 0.15 g |
| 0.4 M | 0.20 | 2 min | 0.20 g |

The results of the experiments show that the rate of the reaction increases with the increase of the concentration of the solution.

| Concentration of the solution | Rate of the reaction | Time taken for the reaction to complete | Amount of the substance which reacts |
|-------------------------------|----------------------|---|--------------------------------------|
| 0.1 M | 0.05 | 10 min | 0.05 g |
| 0.2 M | 0.10 | 5 min | 0.10 g |
| 0.3 M | 0.15 | 3 min | 0.15 g |
| 0.4 M | 0.20 | 2 min | 0.20 g |
| 0.5 M | 0.25 | 1.5 min | 0.25 g |
| 0.6 M | 0.30 | 1 min | 0.30 g |
| 0.7 M | 0.35 | 0.7 min | 0.35 g |
| 0.8 M | 0.40 | 0.5 min | 0.40 g |
| 0.9 M | 0.45 | 0.4 min | 0.45 g |
| 1.0 M | 0.50 | 0.3 min | 0.50 g |

The results of the experiments show that the rate of the reaction increases with the increase of the concentration of the solution.

The rate of the reaction is expressed in terms of the amount of the substance which reacts in a given time.

The results of the experiments show that the rate of the reaction increases with the increase of the concentration of the solution.

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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-12 DATE TESTED: July 29, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 57.91 | 56.16 | 57.46 |
| DRY WEIGHT | 47.60 | 45.03 | 47.18 |
| WEIGHT OF WATER | 10.31 | 11.13 | 10.28 |
| MOISTURE CONTENT (%) | 21.7 | 24.7 | 21.8 |

AVERAGE MOISTURE CONTENT: 22.7%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 50.04 | 48.76 | 49.73 |
| DRY WEIGHT | | 47.60 | 45.03 | 47.18 |
| WEIGHT OF PARAFFIN | | 2.44 | 3.73 | 2.55 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 94 | 98 | 91 |
| | 2 | 94 | 98 | 91 |
| | NUMBER 3 | 94 | 98 | 91 |
| | SUM | | | |
| | AVERAGE | 94.0 | 98.0 | 91.0 |
| *VOLUME OF PARAFFIN | | 2.7 | 4.2 | 2.9 |
| VOLUME OF SAMPLE | | 91.3 | 93.8 | 88.1 |
| SPECIFIC GRAVITY | | 0.522 | 0.480 | 0.535 |

AVERAGE SPECIFIC GRAVITY: 0.512

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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| Author | Title | Year | Notes |
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BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-13 DATE TESTED: July 29, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 39.13 | 63.02 | 42.18 |
| DRY WEIGHT | 32.40 | 50.76 | 34.98 |
| WEIGHT OF WATER | 6.73 | 12.26 | 7.20 |
| MOISTURE CONTENT (%) | 20.8 | 24.2 | 20.6 |

AVERAGE MOISTURE CONTENT: 21.9%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 35.25 | 54.92 | 37.90 |
| DRY WEIGHT | | 32.40 | 50.76 | 34.98 |
| WEIGHT OF PARAFFIN | | 2.85 | 4.16 | 2.92 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 81 | 107 | 86 |
| | 2 | 81 | 106 | 85 |
| | NUMBER 3 | 81 | 105 | 85 |
| | SUM | | 318 | 256 |
| | AVERAGE | 81.0 | 106.0 | 85.3 |
| *VOLUME OF PARAFFIN | | 3.2 | 4.7 | 3.3 |
| VOLUME OF SAMPLE | | 77.8 | 101.3 | 82.0 |
| SPECIFIC GRAVITY | | 0.417 | 0.501 | 0.427 |

AVERAGE SPECIFIC GRAVITY: 0.448

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE I

Summary of the data

for the year 1950

| Year | 1949 | 1950 | 1951 |
|------|------|------|------|
| Jan. | 100 | 100 | 100 |
| Feb. | 100 | 100 | 100 |
| Mar. | 100 | 100 | 100 |
| Apr. | 100 | 100 | 100 |

Continued on next page

| Year | 1949 | 1950 | 1951 |
|-------|------|------|------|
| May | 100 | 100 | 100 |
| Jun. | 100 | 100 | 100 |
| Jul. | 100 | 100 | 100 |
| Aug. | 100 | 100 | 100 |
| Sep. | 100 | 100 | 100 |
| Oct. | 100 | 100 | 100 |
| Nov. | 100 | 100 | 100 |
| Dec. | 100 | 100 | 100 |
| Total | 1000 | 1000 | 1000 |

Continued on next page

for the year 1950

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-14 DATE TESTED: July 29, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 56.73 | 59.97 | 47.38 |
| DRY WEIGHT | 46.89 | 49.57 | 39.19 |
| WEIGHT OF WATER | 9.84 | 10.40 | 8.19 |
| MOISTURE CONTENT (%) | 21.0 | 21.0 | 20.9 |

AVERAGE MOISTURE CONTENT: 21.0%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 49.17 | 52.82 | 41.54 |
| DRY WEIGHT | | 46.89 | 49.57 | 39.19 |
| WEIGHT OF PARAFFIN | | 2.28 | 3.25 | 2.35 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 93 | 107 | 75 |
| | 2 | 93 | 107 | 75 |
| | NUMBER 3 | 93 | 107 | 75 |
| | SUM | | | |
| | AVERAGE | 93.0 | 107.0 | 75.0 |
| *VOLUME OF PARAFFIN | | 2.6 | 3.6 | 2.6 |
| VOLUME OF SAMPLE | | 90.4 | 103.4 | 72.4 |
| SPECIFIC GRAVITY | | 0.519 | 0.479 | 0.542 |

AVERAGE SPECIFIC GRAVITY: 0.513

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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500 EAST HARTWELL STREET, CHICAGO, ILL. 60607

DATE

BY

NO.

| DATE | BY | NO. | REMARKS |
|------|-----|-----|---------|
| 1950 | ... | ... | ... |
| 1951 | ... | ... | ... |
| 1952 | ... | ... | ... |
| 1953 | ... | ... | ... |

...

| DATE | BY | NO. | REMARKS |
|------|-----|-----|---------|
| 1954 | ... | ... | ... |
| 1955 | ... | ... | ... |
| 1956 | ... | ... | ... |
| 1957 | ... | ... | ... |
| 1958 | ... | ... | ... |
| 1959 | ... | ... | ... |
| 1960 | ... | ... | ... |
| 1961 | ... | ... | ... |
| 1962 | ... | ... | ... |
| 1963 | ... | ... | ... |
| 1964 | ... | ... | ... |
| 1965 | ... | ... | ... |
| 1966 | ... | ... | ... |
| 1967 | ... | ... | ... |
| 1968 | ... | ... | ... |
| 1969 | ... | ... | ... |
| 1970 | ... | ... | ... |

...

...

...

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: B-15 DATE TESTED: August 24, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 33.91 | 66.79 | 38.83 |
| DRY WEIGHT | 26.91 | 53.94 | 31.30 |
| WEIGHT OF WATER | 7.00 | 12.85 | 7.53 |
| MOISTURE CONTENT (%) | 26.0 | 23.8 | 24.0 |

AVERAGE MOISTURE CONTENT: 24.6%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 29.44 | 58.72 | 34.00 |
| DRY WEIGHT | | 26.91 | 53.94 | 31.30 |
| WEIGHT OF PARAFFIN | | 2.53 | 4.78 | 2.70 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 66 | 112 | 73 |
| | 2 | 67 | 113 | 73 |
| | 3 | 65 | 113 | 73 |
| | SUM | 198 | 338 | |
| | AVERAGE | 66.0 | 112.7 | 73.0 |
| *VOLUME OF PARAFFIN | | 2.8 | 5.4 | 3.0 |
| VOLUME OF SAMPLE | | 63.2 | 107.3 | 70.0 |
| SPECIFIC GRAVITY | | 0.427 | 0.502 | 0.447 |

AVERAGE SPECIFIC GRAVITY: 0.459

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-1 DATE TESTED: Sept. 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 43.03 | 43.24 | 43.09 |
| DRY WEIGHT | 39.50 | 39.36 | 39.52 |
| WEIGHT OF WATER | 3.53 | 3.88 | 3.57 |
| MOISTURE CONTENT (%) | 8.9 | 9.9 | 9.0 |

AVERAGE MOISTURE CONTENT: 9.3%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 42.11 | 41.85 | 41.88 |
| DRY WEIGHT | | 39.50 | 39.36 | 39.52 |
| WEIGHT OF PARAFFIN | | 2.61 | 2.49 | 2.36 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 93 | 95 | 90 |
| | 2 | 92 | 95 | 90 |
| | NUMBER 3 | 93 | 95 | 90 |
| | SUM | 278 | | |
| | AVERAGE | 92.7 | 95.0 | 90.0 |
| *VOLUME OF PARAFFIN | | 2.9 | 2.8 | 2.6 |
| VOLUME OF SAMPLE | | 89.8 | 92.2 | 87.4 |
| SPECIFIC GRAVITY | | 0.440 | 0.426 | 0.453 |

AVERAGE SPECIFIC GRAVITY: 0.440

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THE UNIVERSITY OF CHICAGO DEPARTMENT OF CHEMISTRY

RECORD OF EXPERIMENTAL DATA

| DATE | TIME | TEMPERATURE | PRESSURE |
|------|-------|-------------|----------|
| 1900 | 10.00 | 20.0 | 760.0 |
| 1900 | 10.10 | 20.0 | 760.0 |
| 1900 | 10.20 | 20.0 | 760.0 |
| 1900 | 10.30 | 20.0 | 760.0 |
| 1900 | 10.40 | 20.0 | 760.0 |

ANALYSIS OF RESULTS

| DATE | TIME | TEMPERATURE | PRESSURE | ANALYSIS |
|------|-------|-------------|----------|----------|
| 1900 | 10.00 | 20.0 | 760.0 | 100.0 |
| 1900 | 10.10 | 20.0 | 760.0 | 100.0 |
| 1900 | 10.20 | 20.0 | 760.0 | 100.0 |
| 1900 | 10.30 | 20.0 | 760.0 | 100.0 |
| 1900 | 10.40 | 20.0 | 760.0 | 100.0 |
| 1900 | 10.50 | 20.0 | 760.0 | 100.0 |
| 1900 | 11.00 | 20.0 | 760.0 | 100.0 |
| 1900 | 11.10 | 20.0 | 760.0 | 100.0 |
| 1900 | 11.20 | 20.0 | 760.0 | 100.0 |
| 1900 | 11.30 | 20.0 | 760.0 | 100.0 |
| 1900 | 11.40 | 20.0 | 760.0 | 100.0 |
| 1900 | 11.50 | 20.0 | 760.0 | 100.0 |

CONCLUSIONS

It is concluded that the results of the experiment are in good agreement with the theoretical predictions.

Respectfully,
 J. H. VAN VLECK

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-2 DATE TESTED: Sept. 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 45.40 | 61.41 | 45.77 |
| DRY WEIGHT | 41.58 | 55.88 | 42.00 |
| WEIGHT OF WATER | 3.82 | 5.53 | 3.77 |
| MOISTURE CONTENT (%) | 9.2 | 9.9 | 9.0 |

AVERAGE MOISTURE CONTENT: 9.4

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 43.68 | 58.80 | 43.94 |
| DRY WEIGHT | | 41.58 | 55.88 | 42.00 |
| WEIGHT OF PARAFFIN | | 2.10 | 2.92 | 1.94 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 96 | 124 | 94 |
| | 2 | 96 | 126 | 94 |
| | 3 | 96 | 125 | 94 |
| | SUM | | 375 | |
| | AVERAGE | 96.0 | 125.0 | 94.0 |
| *VOLUME OF PARAFFIN | | 2.4 | 3.3 | 2.2 |
| VOLUME OF SAMPLE | | 93.6 | 121.7 | 91.8 |
| SPECIFIC GRAVITY | | 0.444 | 0.460 | 0.458 |

AVERAGE SPECIFIC GRAVITY: 0.454

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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| DATE | DESCRIPTION | AMOUNT | BALANCE |
|------|-------------|--------|---------|
| 1900 | Jan 1 | 100.00 | 100.00 |
| 1901 | Jan 1 | 100.00 | 100.00 |
| 1902 | Jan 1 | 100.00 | 100.00 |
| 1903 | Jan 1 | 100.00 | 100.00 |

| DATE | DESCRIPTION | AMOUNT | BALANCE |
|------|-------------|--------|---------|
| 1904 | Jan 1 | 100.00 | 100.00 |
| 1905 | Jan 1 | 100.00 | 100.00 |
| 1906 | Jan 1 | 100.00 | 100.00 |
| 1907 | Jan 1 | 100.00 | 100.00 |
| 1908 | Jan 1 | 100.00 | 100.00 |
| 1909 | Jan 1 | 100.00 | 100.00 |
| 1910 | Jan 1 | 100.00 | 100.00 |
| 1911 | Jan 1 | 100.00 | 100.00 |
| 1912 | Jan 1 | 100.00 | 100.00 |
| 1913 | Jan 1 | 100.00 | 100.00 |
| 1914 | Jan 1 | 100.00 | 100.00 |
| 1915 | Jan 1 | 100.00 | 100.00 |
| 1916 | Jan 1 | 100.00 | 100.00 |
| 1917 | Jan 1 | 100.00 | 100.00 |
| 1918 | Jan 1 | 100.00 | 100.00 |
| 1919 | Jan 1 | 100.00 | 100.00 |
| 1920 | Jan 1 | 100.00 | 100.00 |

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Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-3 DATE TESTED: Sept. 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 51.89 | 55.42 | 50.45 |
| DRY WEIGHT | 47.55 | 50.36 | 46.08 |
| WEIGHT OF WATER | 4.34 | 5.06 | 4.37 |
| MOISTURE CONTENT (%) | 9.1 | 10.0 | 9.5 |

AVERAGE MOISTURE CONTENT: 9.5%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 50.22 | 52.98 | 48.02 |
| DRY WEIGHT | | 47.55 | 50.36 | 46.08 |
| WEIGHT OF PARAFFIN | | 2.67 | 2.62 | 1.94 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 110 | 118 | 91 |
| | 2 | 110 | 118 | 92 |
| | NUMBER 3 | 110 | 118 | 92 |
| | SUM | | | 275 |
| | AVERAGE | 110.0 | 118.0 | 91.7 |
| *VOLUME OF PARAFFIN | | 3.0 | 2.9 | 2.2 |
| VOLUME OF SAMPLE | | 107.0 | 115.1 | 89.5 |
| SPECIFIC GRAVITY | | 0.445 | 0.437 | 0.515 |

AVERAGE SPECIFIC GRAVITY: 0.466

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-4 DATE TESTED: Sept. 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 46.34 | 69.43 | 32.73 |
| DRY WEIGHT | 42.36 | 62.90 | 29.90 |
| WEIGHT OF WATER | 3.98 | 6.53 | 2.83 |
| MOISTURE CONTENT (%) | 9.4 | 10.4 | 9.5 |

AVERAGE MOISTURE CONTENT: 9.8%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 44.77 | 66.28 | 31.71 |
| DRY WEIGHT | | 42.36 | 62.90 | 29.90 |
| WEIGHT OF PARAFFIN | | 2.41 | 3.38 | 1.81 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 97 | 124 | 68 |
| | 2 | 98 | 124 | 68 |
| | NUMBER 3 | 98 | 124 | 68 |
| | SUM | 293 | | |
| | AVERAGE | 97.7 | 124.0 | 68.0 |
| *VOLUME OF PARAFFIN | | 2.7 | 3.8 | 2.0 |
| VOLUME OF SAMPLE | | 95.0 | 120.2 | 66.0 |
| SPECIFIC GRAVITY | | 0.446 | 0.522 | 0.453 |

AVERAGE SPECIFIC GRAVITY: 0.474

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THE UNIVERSITY OF CHICAGO DEPARTMENT OF CHEMISTRY REPORT ON THE PROGRESS OF RESEARCH

| DATE | NAME | PROJECT | RESULTS |
|------|----------|---------|---------|
| 1911 | W. R. R. | ... | ... |
| 1912 | W. R. R. | ... | ... |
| 1913 | W. R. R. | ... | ... |
| 1914 | W. R. R. | ... | ... |

| DATE | NAME | PROJECT | RESULTS |
|------|----------|---------|---------|
| 1915 | W. R. R. | ... | ... |
| 1916 | W. R. R. | ... | ... |
| 1917 | W. R. R. | ... | ... |
| 1918 | W. R. R. | ... | ... |
| 1919 | W. R. R. | ... | ... |
| 1920 | W. R. R. | ... | ... |
| 1921 | W. R. R. | ... | ... |
| 1922 | W. R. R. | ... | ... |
| 1923 | W. R. R. | ... | ... |
| 1924 | W. R. R. | ... | ... |
| 1925 | W. R. R. | ... | ... |
| 1926 | W. R. R. | ... | ... |
| 1927 | W. R. R. | ... | ... |
| 1928 | W. R. R. | ... | ... |
| 1929 | W. R. R. | ... | ... |
| 1930 | W. R. R. | ... | ... |

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-5 DATE TESTED: Sept. 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 51.66 | 68.87 | 49.21 |
| DRY WEIGHT | 47.38 | 62.46 | 45.00 |
| WEIGHT OF WATER | 4.28 | 6.41 | 4.21 |
| MOISTURE CONTENT (%) | 9.0 | 10.3 | 9.4 |

AVERAGE MOISTURE CONTENT: 9.6%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 49.80 | 65.84 | 47.10 |
| DRY WEIGHT | | 47.38 | 62.46 | 45.00 |
| WEIGHT OF PARAFFIN | | 2.42 | 3.38 | 2.10 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 108 | 124 | 95 |
| | 2 | 109 | 124 | 96 |
| | 3 | 109 | 124 | 96 |
| | SUM | 326 | | 287 |
| | AVERAGE | 108.7 | 124.0 | 95.7 |
| *VOLUME OF PARAFFIN | | 2.7 | 3.8 | 2.4 |
| VOLUME OF SAMPLE | | 106.0 | 120.2 | 93.3 |
| SPECIFIC GRAVITY | | 0.446 | 0.519 | 0.483 |

AVERAGE SPECIFIC GRAVITY: 0.483

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE 1. Summary of the results of the 1981-82 survey of the distribution of the common carp in the Great Lakes.

Survey conducted by the U.S. Fish and Wildlife Service, Great Lakes Division, Detroit, Michigan.

Survey conducted by the U.S. Fish and Wildlife Service, Great Lakes Division, Detroit, Michigan.

| Year | 1981 | 1982 | 1983 |
|------|------|------|------|
| 1981 | 1981 | 1981 | 1981 |
| 1982 | 1982 | 1982 | 1982 |
| 1983 | 1983 | 1983 | 1983 |
| 1984 | 1984 | 1984 | 1984 |

TABLE 2. Summary of the results of the 1981-82 survey of the distribution of the common carp in the Great Lakes.

| Year | 1981 | 1982 | 1983 |
|------|------|------|------|
| 1981 | 1981 | 1981 | 1981 |
| 1982 | 1982 | 1982 | 1982 |
| 1983 | 1983 | 1983 | 1983 |
| 1984 | 1984 | 1984 | 1984 |
| 1985 | 1985 | 1985 | 1985 |
| 1986 | 1986 | 1986 | 1986 |
| 1987 | 1987 | 1987 | 1987 |
| 1988 | 1988 | 1988 | 1988 |
| 1989 | 1989 | 1989 | 1989 |
| 1990 | 1990 | 1990 | 1990 |
| 1991 | 1991 | 1991 | 1991 |
| 1992 | 1992 | 1992 | 1992 |
| 1993 | 1993 | 1993 | 1993 |
| 1994 | 1994 | 1994 | 1994 |
| 1995 | 1995 | 1995 | 1995 |
| 1996 | 1996 | 1996 | 1996 |
| 1997 | 1997 | 1997 | 1997 |
| 1998 | 1998 | 1998 | 1998 |
| 1999 | 1999 | 1999 | 1999 |
| 2000 | 2000 | 2000 | 2000 |
| 2001 | 2001 | 2001 | 2001 |
| 2002 | 2002 | 2002 | 2002 |
| 2003 | 2003 | 2003 | 2003 |
| 2004 | 2004 | 2004 | 2004 |
| 2005 | 2005 | 2005 | 2005 |
| 2006 | 2006 | 2006 | 2006 |
| 2007 | 2007 | 2007 | 2007 |
| 2008 | 2008 | 2008 | 2008 |
| 2009 | 2009 | 2009 | 2009 |
| 2010 | 2010 | 2010 | 2010 |
| 2011 | 2011 | 2011 | 2011 |
| 2012 | 2012 | 2012 | 2012 |
| 2013 | 2013 | 2013 | 2013 |
| 2014 | 2014 | 2014 | 2014 |
| 2015 | 2015 | 2015 | 2015 |
| 2016 | 2016 | 2016 | 2016 |
| 2017 | 2017 | 2017 | 2017 |
| 2018 | 2018 | 2018 | 2018 |
| 2019 | 2019 | 2019 | 2019 |
| 2020 | 2020 | 2020 | 2020 |
| 2021 | 2021 | 2021 | 2021 |
| 2022 | 2022 | 2022 | 2022 |
| 2023 | 2023 | 2023 | 2023 |
| 2024 | 2024 | 2024 | 2024 |
| 2025 | 2025 | 2025 | 2025 |
| 2026 | 2026 | 2026 | 2026 |
| 2027 | 2027 | 2027 | 2027 |
| 2028 | 2028 | 2028 | 2028 |
| 2029 | 2029 | 2029 | 2029 |
| 2030 | 2030 | 2030 | 2030 |
| 2031 | 2031 | 2031 | 2031 |
| 2032 | 2032 | 2032 | 2032 |
| 2033 | 2033 | 2033 | 2033 |
| 2034 | 2034 | 2034 | 2034 |
| 2035 | 2035 | 2035 | 2035 |
| 2036 | 2036 | 2036 | 2036 |
| 2037 | 2037 | 2037 | 2037 |
| 2038 | 2038 | 2038 | 2038 |
| 2039 | 2039 | 2039 | 2039 |
| 2040 | 2040 | 2040 | 2040 |
| 2041 | 2041 | 2041 | 2041 |
| 2042 | 2042 | 2042 | 2042 |
| 2043 | 2043 | 2043 | 2043 |
| 2044 | 2044 | 2044 | 2044 |
| 2045 | 2045 | 2045 | 2045 |
| 2046 | 2046 | 2046 | 2046 |
| 2047 | 2047 | 2047 | 2047 |
| 2048 | 2048 | 2048 | 2048 |
| 2049 | 2049 | 2049 | 2049 |
| 2050 | 2050 | 2050 | 2050 |
| 2051 | 2051 | 2051 | 2051 |
| 2052 | 2052 | 2052 | 2052 |
| 2053 | 2053 | 2053 | 2053 |
| 2054 | 2054 | 2054 | 2054 |
| 2055 | 2055 | 2055 | 2055 |
| 2056 | 2056 | 2056 | 2056 |
| 2057 | 2057 | 2057 | 2057 |
| 2058 | 2058 | 2058 | 2058 |
| 2059 | 2059 | 2059 | 2059 |
| 2060 | 2060 | 2060 | 2060 |
| 2061 | 2061 | 2061 | 2061 |
| 2062 | 2062 | 2062 | 2062 |
| 2063 | 2063 | 2063 | 2063 |
| 2064 | 2064 | 2064 | 2064 |
| 2065 | 2065 | 2065 | 2065 |
| 2066 | 2066 | 2066 | 2066 |
| 2067 | 2067 | 2067 | 2067 |
| 2068 | 2068 | 2068 | 2068 |
| 2069 | 2069 | 2069 | 2069 |
| 2070 | 2070 | 2070 | 2070 |
| 2071 | 2071 | 2071 | 2071 |
| 2072 | 2072 | 2072 | 2072 |
| 2073 | 2073 | 2073 | 2073 |
| 2074 | 2074 | 2074 | 2074 |
| 2075 | 2075 | 2075 | 2075 |
| 2076 | 2076 | 2076 | 2076 |
| 2077 | 2077 | 2077 | 2077 |
| 2078 | 2078 | 2078 | 2078 |
| 2079 | 2079 | 2079 | 2079 |
| 2080 | 2080 | 2080 | 2080 |
| 2081 | 2081 | 2081 | 2081 |
| 2082 | 2082 | 2082 | 2082 |
| 2083 | 2083 | 2083 | 2083 |
| 2084 | 2084 | 2084 | 2084 |
| 2085 | 2085 | 2085 | 2085 |
| 2086 | 2086 | 2086 | 2086 |
| 2087 | 2087 | 2087 | 2087 |
| 2088 | 2088 | 2088 | 2088 |
| 2089 | 2089 | 2089 | 2089 |
| 2090 | 2090 | 2090 | 2090 |
| 2091 | 2091 | 2091 | 2091 |
| 2092 | 2092 | 2092 | 2092 |
| 2093 | 2093 | 2093 | 2093 |
| 2094 | 2094 | 2094 | 2094 |
| 2095 | 2095 | 2095 | 2095 |
| 2096 | 2096 | 2096 | 2096 |
| 2097 | 2097 | 2097 | 2097 |
| 2098 | 2098 | 2098 | 2098 |
| 2099 | 2099 | 2099 | 2099 |
| 2100 | 2100 | 2100 | 2100 |

TABLE 3. Summary of the results of the 1981-82 survey of the distribution of the common carp in the Great Lakes.

Survey conducted by the U.S. Fish and Wildlife Service, Great Lakes Division, Detroit, Michigan.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-6 DATE TESTED: Sept. 14, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 44.96 | 72.32 | 44.09 |
| DRY WEIGHT | 41.04 | 65.60 | 40.38 |
| WEIGHT OF WATER | 3.92 | 6.72 | 3.71 |
| MOISTURE CONTENT (%) | 9.5 | 10.2 | 9.2 |

AVERAGE MOISTURE CONTENT: 9.6%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 43.19 | 68.89 | 42.39 |
| DRY WEIGHT | | 41.04 | 65.60 | 40.38 |
| WEIGHT OF PARAFFIN | | 2.15 | 3.29 | 2.01 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 94 | 129 | 89 |
| | 2 | 94 | 130 | 89 |
| | 3 | 94 | 129 | 89 |
| | SUM | | 388 | |
| | AVERAGE | 94.0 | 129.3 | 89.0 |
| *VOLUME OF PARAFFIN | | 2.4 | 3.7 | 2.2 |
| VOLUME OF SAMPLE | | 91.6 | 125.6 | 86.8 |
| SPECIFIC GRAVITY | | 0.448 | 0.523 | 0.465 |

AVERAGE SPECIFIC GRAVITY: 0.479

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

General Ledger

For the Year Ending December 31, 1900

Balance Forward

Page 1

| Debit | Credit | Balance | Particulars |
|--------|--------|---------|-----------------|
| 100.00 | | 100.00 | Balance Forward |
| | 50.00 | 50.00 | Income |
| 20.00 | | 30.00 | Expenses |
| | 30.00 | 60.00 | Income |
| 10.00 | | 50.00 | Expenses |

Balance Forward

| | | | |
|----------|----------|----------|----------|
| 100.00 | 100.00 | 100.00 | 100.00 |
| 200.00 | 200.00 | 200.00 | 200.00 |
| 300.00 | 300.00 | 300.00 | 300.00 |
| 400.00 | 400.00 | 400.00 | 400.00 |
| 500.00 | 500.00 | 500.00 | 500.00 |
| 600.00 | 600.00 | 600.00 | 600.00 |
| 700.00 | 700.00 | 700.00 | 700.00 |
| 800.00 | 800.00 | 800.00 | 800.00 |
| 900.00 | 900.00 | 900.00 | 900.00 |
| 1000.00 | 1000.00 | 1000.00 | 1000.00 |
| 1100.00 | 1100.00 | 1100.00 | 1100.00 |
| 1200.00 | 1200.00 | 1200.00 | 1200.00 |
| 1300.00 | 1300.00 | 1300.00 | 1300.00 |
| 1400.00 | 1400.00 | 1400.00 | 1400.00 |
| 1500.00 | 1500.00 | 1500.00 | 1500.00 |
| 1600.00 | 1600.00 | 1600.00 | 1600.00 |
| 1700.00 | 1700.00 | 1700.00 | 1700.00 |
| 1800.00 | 1800.00 | 1800.00 | 1800.00 |
| 1900.00 | 1900.00 | 1900.00 | 1900.00 |
| 2000.00 | 2000.00 | 2000.00 | 2000.00 |
| 2100.00 | 2100.00 | 2100.00 | 2100.00 |
| 2200.00 | 2200.00 | 2200.00 | 2200.00 |
| 2300.00 | 2300.00 | 2300.00 | 2300.00 |
| 2400.00 | 2400.00 | 2400.00 | 2400.00 |
| 2500.00 | 2500.00 | 2500.00 | 2500.00 |
| 2600.00 | 2600.00 | 2600.00 | 2600.00 |
| 2700.00 | 2700.00 | 2700.00 | 2700.00 |
| 2800.00 | 2800.00 | 2800.00 | 2800.00 |
| 2900.00 | 2900.00 | 2900.00 | 2900.00 |
| 3000.00 | 3000.00 | 3000.00 | 3000.00 |
| 3100.00 | 3100.00 | 3100.00 | 3100.00 |
| 3200.00 | 3200.00 | 3200.00 | 3200.00 |
| 3300.00 | 3300.00 | 3300.00 | 3300.00 |
| 3400.00 | 3400.00 | 3400.00 | 3400.00 |
| 3500.00 | 3500.00 | 3500.00 | 3500.00 |
| 3600.00 | 3600.00 | 3600.00 | 3600.00 |
| 3700.00 | 3700.00 | 3700.00 | 3700.00 |
| 3800.00 | 3800.00 | 3800.00 | 3800.00 |
| 3900.00 | 3900.00 | 3900.00 | 3900.00 |
| 4000.00 | 4000.00 | 4000.00 | 4000.00 |
| 4100.00 | 4100.00 | 4100.00 | 4100.00 |
| 4200.00 | 4200.00 | 4200.00 | 4200.00 |
| 4300.00 | 4300.00 | 4300.00 | 4300.00 |
| 4400.00 | 4400.00 | 4400.00 | 4400.00 |
| 4500.00 | 4500.00 | 4500.00 | 4500.00 |
| 4600.00 | 4600.00 | 4600.00 | 4600.00 |
| 4700.00 | 4700.00 | 4700.00 | 4700.00 |
| 4800.00 | 4800.00 | 4800.00 | 4800.00 |
| 4900.00 | 4900.00 | 4900.00 | 4900.00 |
| 5000.00 | 5000.00 | 5000.00 | 5000.00 |
| 5100.00 | 5100.00 | 5100.00 | 5100.00 |
| 5200.00 | 5200.00 | 5200.00 | 5200.00 |
| 5300.00 | 5300.00 | 5300.00 | 5300.00 |
| 5400.00 | 5400.00 | 5400.00 | 5400.00 |
| 5500.00 | 5500.00 | 5500.00 | 5500.00 |
| 5600.00 | 5600.00 | 5600.00 | 5600.00 |
| 5700.00 | 5700.00 | 5700.00 | 5700.00 |
| 5800.00 | 5800.00 | 5800.00 | 5800.00 |
| 5900.00 | 5900.00 | 5900.00 | 5900.00 |
| 6000.00 | 6000.00 | 6000.00 | 6000.00 |
| 6100.00 | 6100.00 | 6100.00 | 6100.00 |
| 6200.00 | 6200.00 | 6200.00 | 6200.00 |
| 6300.00 | 6300.00 | 6300.00 | 6300.00 |
| 6400.00 | 6400.00 | 6400.00 | 6400.00 |
| 6500.00 | 6500.00 | 6500.00 | 6500.00 |
| 6600.00 | 6600.00 | 6600.00 | 6600.00 |
| 6700.00 | 6700.00 | 6700.00 | 6700.00 |
| 6800.00 | 6800.00 | 6800.00 | 6800.00 |
| 6900.00 | 6900.00 | 6900.00 | 6900.00 |
| 7000.00 | 7000.00 | 7000.00 | 7000.00 |
| 7100.00 | 7100.00 | 7100.00 | 7100.00 |
| 7200.00 | 7200.00 | 7200.00 | 7200.00 |
| 7300.00 | 7300.00 | 7300.00 | 7300.00 |
| 7400.00 | 7400.00 | 7400.00 | 7400.00 |
| 7500.00 | 7500.00 | 7500.00 | 7500.00 |
| 7600.00 | 7600.00 | 7600.00 | 7600.00 |
| 7700.00 | 7700.00 | 7700.00 | 7700.00 |
| 7800.00 | 7800.00 | 7800.00 | 7800.00 |
| 7900.00 | 7900.00 | 7900.00 | 7900.00 |
| 8000.00 | 8000.00 | 8000.00 | 8000.00 |
| 8100.00 | 8100.00 | 8100.00 | 8100.00 |
| 8200.00 | 8200.00 | 8200.00 | 8200.00 |
| 8300.00 | 8300.00 | 8300.00 | 8300.00 |
| 8400.00 | 8400.00 | 8400.00 | 8400.00 |
| 8500.00 | 8500.00 | 8500.00 | 8500.00 |
| 8600.00 | 8600.00 | 8600.00 | 8600.00 |
| 8700.00 | 8700.00 | 8700.00 | 8700.00 |
| 8800.00 | 8800.00 | 8800.00 | 8800.00 |
| 8900.00 | 8900.00 | 8900.00 | 8900.00 |
| 9000.00 | 9000.00 | 9000.00 | 9000.00 |
| 9100.00 | 9100.00 | 9100.00 | 9100.00 |
| 9200.00 | 9200.00 | 9200.00 | 9200.00 |
| 9300.00 | 9300.00 | 9300.00 | 9300.00 |
| 9400.00 | 9400.00 | 9400.00 | 9400.00 |
| 9500.00 | 9500.00 | 9500.00 | 9500.00 |
| 9600.00 | 9600.00 | 9600.00 | 9600.00 |
| 9700.00 | 9700.00 | 9700.00 | 9700.00 |
| 9800.00 | 9800.00 | 9800.00 | 9800.00 |
| 9900.00 | 9900.00 | 9900.00 | 9900.00 |
| 10000.00 | 10000.00 | 10000.00 | 10000.00 |

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-7 DATE TESTED: Sept. 15, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 49.57 | 74.66 | 52.80 |
| DRY WEIGHT | 45.13 | 67.48 | 48.13 |
| WEIGHT OF WATER | 4.44 | 7.18 | 4.67 |
| MOISTURE CONTENT (%) | 9.8 | 10.6 | 9.7 |

AVERAGE MOISTURE CONTENT: 10.0%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 47.08 | 69.31 | 50.15 |
| DRY WEIGHT | | 45.13 | 67.48 | 48.13 |
| WEIGHT OF PARAFFIN | | 1.95 | 1.83 | 2.02 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 80 | 115 | 88 |
| | 2 | 80 | 115 | 88 |
| | 3 | 80 | 115 | 88 |
| | SUM | | | |
| | AVERAGE | 80.0 | 115.0 | 88.0 |
| *VOLUME OF PARAFFIN | | 2.2 | 2.1 | 2.3 |
| VOLUME OF SAMPLE | | 77.8 | 112.9 | 85.7 |
| SPECIFIC GRAVITY | | 0.581 | 0.598 | 0.562 |

AVERAGE SPECIFIC GRAVITY: 0.580

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS

STATE OF NEW YORK

IN SENATE

January 1, 1900

| ARTICLE | SECTION | AMOUNT | REMARKS |
|---------|---------|--------|-------------------|
| 1 | 1 | 100.00 | For the year 1900 |
| 2 | 2 | 100.00 | For the year 1900 |
| 3 | 3 | 100.00 | For the year 1900 |
| 4 | 4 | 100.00 | For the year 1900 |

100.00

| ARTICLE | SECTION | AMOUNT | REMARKS |
|---------|---------|--------|-------------------|
| 1 | 1 | 100.00 | For the year 1900 |
| 2 | 2 | 100.00 | For the year 1900 |
| 3 | 3 | 100.00 | For the year 1900 |
| 4 | 4 | 100.00 | For the year 1900 |
| 5 | 5 | 100.00 | For the year 1900 |
| 6 | 6 | 100.00 | For the year 1900 |
| 7 | 7 | 100.00 | For the year 1900 |
| 8 | 8 | 100.00 | For the year 1900 |
| 9 | 9 | 100.00 | For the year 1900 |
| 10 | 10 | 100.00 | For the year 1900 |
| 11 | 11 | 100.00 | For the year 1900 |
| 12 | 12 | 100.00 | For the year 1900 |
| 13 | 13 | 100.00 | For the year 1900 |
| 14 | 14 | 100.00 | For the year 1900 |
| 15 | 15 | 100.00 | For the year 1900 |
| 16 | 16 | 100.00 | For the year 1900 |
| 17 | 17 | 100.00 | For the year 1900 |
| 18 | 18 | 100.00 | For the year 1900 |
| 19 | 19 | 100.00 | For the year 1900 |
| 20 | 20 | 100.00 | For the year 1900 |
| 21 | 21 | 100.00 | For the year 1900 |
| 22 | 22 | 100.00 | For the year 1900 |
| 23 | 23 | 100.00 | For the year 1900 |
| 24 | 24 | 100.00 | For the year 1900 |
| 25 | 25 | 100.00 | For the year 1900 |
| 26 | 26 | 100.00 | For the year 1900 |
| 27 | 27 | 100.00 | For the year 1900 |
| 28 | 28 | 100.00 | For the year 1900 |
| 29 | 29 | 100.00 | For the year 1900 |
| 30 | 30 | 100.00 | For the year 1900 |
| 31 | 31 | 100.00 | For the year 1900 |
| 32 | 32 | 100.00 | For the year 1900 |
| 33 | 33 | 100.00 | For the year 1900 |
| 34 | 34 | 100.00 | For the year 1900 |
| 35 | 35 | 100.00 | For the year 1900 |
| 36 | 36 | 100.00 | For the year 1900 |
| 37 | 37 | 100.00 | For the year 1900 |
| 38 | 38 | 100.00 | For the year 1900 |
| 39 | 39 | 100.00 | For the year 1900 |
| 40 | 40 | 100.00 | For the year 1900 |
| 41 | 41 | 100.00 | For the year 1900 |
| 42 | 42 | 100.00 | For the year 1900 |
| 43 | 43 | 100.00 | For the year 1900 |
| 44 | 44 | 100.00 | For the year 1900 |
| 45 | 45 | 100.00 | For the year 1900 |
| 46 | 46 | 100.00 | For the year 1900 |
| 47 | 47 | 100.00 | For the year 1900 |
| 48 | 48 | 100.00 | For the year 1900 |
| 49 | 49 | 100.00 | For the year 1900 |
| 50 | 50 | 100.00 | For the year 1900 |
| 51 | 51 | 100.00 | For the year 1900 |
| 52 | 52 | 100.00 | For the year 1900 |
| 53 | 53 | 100.00 | For the year 1900 |
| 54 | 54 | 100.00 | For the year 1900 |
| 55 | 55 | 100.00 | For the year 1900 |
| 56 | 56 | 100.00 | For the year 1900 |
| 57 | 57 | 100.00 | For the year 1900 |
| 58 | 58 | 100.00 | For the year 1900 |
| 59 | 59 | 100.00 | For the year 1900 |
| 60 | 60 | 100.00 | For the year 1900 |
| 61 | 61 | 100.00 | For the year 1900 |
| 62 | 62 | 100.00 | For the year 1900 |
| 63 | 63 | 100.00 | For the year 1900 |
| 64 | 64 | 100.00 | For the year 1900 |
| 65 | 65 | 100.00 | For the year 1900 |
| 66 | 66 | 100.00 | For the year 1900 |
| 67 | 67 | 100.00 | For the year 1900 |
| 68 | 68 | 100.00 | For the year 1900 |
| 69 | 69 | 100.00 | For the year 1900 |
| 70 | 70 | 100.00 | For the year 1900 |
| 71 | 71 | 100.00 | For the year 1900 |
| 72 | 72 | 100.00 | For the year 1900 |
| 73 | 73 | 100.00 | For the year 1900 |
| 74 | 74 | 100.00 | For the year 1900 |
| 75 | 75 | 100.00 | For the year 1900 |
| 76 | 76 | 100.00 | For the year 1900 |
| 77 | 77 | 100.00 | For the year 1900 |
| 78 | 78 | 100.00 | For the year 1900 |
| 79 | 79 | 100.00 | For the year 1900 |
| 80 | 80 | 100.00 | For the year 1900 |
| 81 | 81 | 100.00 | For the year 1900 |
| 82 | 82 | 100.00 | For the year 1900 |
| 83 | 83 | 100.00 | For the year 1900 |
| 84 | 84 | 100.00 | For the year 1900 |
| 85 | 85 | 100.00 | For the year 1900 |
| 86 | 86 | 100.00 | For the year 1900 |
| 87 | 87 | 100.00 | For the year 1900 |
| 88 | 88 | 100.00 | For the year 1900 |
| 89 | 89 | 100.00 | For the year 1900 |
| 90 | 90 | 100.00 | For the year 1900 |
| 91 | 91 | 100.00 | For the year 1900 |
| 92 | 92 | 100.00 | For the year 1900 |
| 93 | 93 | 100.00 | For the year 1900 |
| 94 | 94 | 100.00 | For the year 1900 |
| 95 | 95 | 100.00 | For the year 1900 |
| 96 | 96 | 100.00 | For the year 1900 |
| 97 | 97 | 100.00 | For the year 1900 |
| 98 | 98 | 100.00 | For the year 1900 |
| 99 | 99 | 100.00 | For the year 1900 |
| 100 | 100 | 100.00 | For the year 1900 |

100.00

100.00

100.00

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-8 DATE TESTED: Sept. 15, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 34.99 | 71.02 | 42.35 |
| DRY WEIGHT | 32.06 | 64.21 | 38.81 |
| WEIGHT OF WATER | 2.93 | 6.81 | 3.54 |
| MOISTURE CONTENT (%) | 9.1 | 10.6 | 9.1 |

AVERAGE MOISTURE CONTENT: 9.6%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 33.78 | 66.32 | 40.90 |
| DRY WEIGHT | | 32.06 | 64.21 | 38.81 |
| WEIGHT OF PARAFFIN | | 1.72 | 2.11 | 2.09 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 72 | 111 | 89 |
| | 2 | 71 | 111 | 87 |
| | 3 | 72 | 111 | 89 |
| | SUM | 215 | | 265 |
| | AVERAGE | 71.7 | 111.0 | 88.3 |
| *VOLUME OF PARAFFIN | | 1.9 | 2.4 | 2.3 |
| VOLUME OF SAMPLE | | 69.8 | 108.6 | 86.0 |
| SPECIFIC GRAVITY | | 0.460 | 0.592 | 0.452 |

AVERAGE SPECIFIC GRAVITY: 0.501

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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CHAPTER XXXI. THE HISTORY OF THE UNITED STATES

CHAPTER XXXII. THE HISTORY OF THE UNITED STATES

CHAPTER XXXIII. THE HISTORY OF THE UNITED STATES

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-9 DATE TESTED: Sept. 15, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 47.91 | 74.88 | 53.78 |
| DRY WEIGHT | 43.68 | 67.63 | 48.97 |
| WEIGHT OF WATER | 4.23 | 7.25 | 4.81 |
| MOISTURE CONTENT (%) | 9.7 | 10.7 | 9.8 |

AVERAGE MOISTURE CONTENT: 10.1%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 45.68 | 69.68 | 51.23 |
| DRY WEIGHT | | 43.68 | 67.63 | 48.97 |
| WEIGHT OF PARAFFIN | | 2.00 | 2.05 | 2.26 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 79 | 114 | 89 |
| | 2 | 80 | 115 | 90 |
| | 3 | 80 | 115 | 90 |
| | SUM | 239 | 344 | 269 |
| | AVERAGE | 79.7 | 114.7 | 89.7 |
| *VOLUME OF PARAFFIN | | 2.2 | 2.3 | 2.5 |
| VOLUME OF SAMPLE | | 77.5 | 112.4 | 87.2 |
| SPECIFIC GRAVITY | | 0.564 | 0.601 | 0.561 |

AVERAGE SPECIFIC GRAVITY: 0.575

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-10 DATE TESTED: Sept. 15, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 42.73 | 82.12 | 38.77 |
| DRY WEIGHT | 39.16 | 74.38 | 35.52 |
| WEIGHT OF WATER | 3.57 | 7.74 | 3.25 |
| MOISTURE CONTENT (%) | 9.1 | 10.4 | 9.2 |

AVERAGE MOISTURE CONTENT: 9.6%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 41.05 | 76.28 | 37.32 |
| DRY WEIGHT | | 39.16 | 74.38 | 35.52 |
| WEIGHT OF PARAFFIN | | 1.89 | 1.90 | 1.80 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 88 | 131 | 79 |
| | 2 | 88 | 131 | 79 |
| | 3 | 88 | 131 | 79 |
| | SUM | | | |
| | AVERAGE | 88.0 | 131.0 | 79.0 |
| *VOLUME OF PARAFFIN | | 2.1 | 2.1 | 2.0 |
| VOLUME OF SAMPLE | | 85.9 | 128.9 | 77.0 |
| SPECIFIC GRAVITY | | 0.456 | 0.577 | 0.462 |

AVERAGE SPECIFIC GRAVITY: 0.498

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-11 DATE TESTED: Sept. 15, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 38.13 | 82.61 | 42.49 |
| DRY WEIGHT | 34.97 | 74.59 | 38.91 |
| WEIGHT OF WATER | 3.16 | 8.02 | 3.58 |
| MOISTURE CONTENT (%) | 9.0 | 10.7 | 9.2 |

AVERAGE MOISTURE CONTENT: 9.6%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 36.73 | 76.58 | 40.88 |
| DRY WEIGHT | | 34.97 | 74.59 | 38.91 |
| WEIGHT OF PARAFFIN | | 1.76 | 1.99 | 1.97 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 80 | 129 | 87 |
| | 2 | 80 | 129 | 88 |
| | NUMBER 3 | 80 | 129 | 88 |
| | SUM | | | 263 |
| | AVERAGE | 80.0 | 129.0 | 87.7 |
| *VOLUME OF PARAFFIN | | 2.0 | 2.2 | 2.2 |
| VOLUME OF SAMPLE | | 78.0 | 126.8 | 85.5 |
| SPECIFIC GRAVITY | | 0.448 | 0.589 | 0.455 |

AVERAGE SPECIFIC GRAVITY: 0.497

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-12 DATE TESTED: Sept. 15, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 42.49 | 74.15 | 48.43 |
| DRY WEIGHT | 38.86 | 67.20 | 44.32 |
| WEIGHT OF WATER | 3.63 | 6.95 | 4.11 |
| MOISTURE CONTENT (%) | 9.3 | 10.3 | 9.3 |

AVERAGE MOISTURE CONTENT: 9.6%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 40.41 | 70.65 | 46.05 |
| DRY WEIGHT | | 38.86 | 67.20 | 44.32 |
| WEIGHT OF PARAFFIN | | 1.55 | 3.45 | 1.73 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 82 | 131 | 87 |
| | 2 | 80 | 131 | 89 |
| | 3 | 81 | 131 | 89 |
| | SUM | 243 | | 265 |
| | AVERAGE | 81.0 | 131.0 | 88.3 |
| *VOLUME OF PARAFFIN | | 1.7 | 3.9 | 1.9 |
| VOLUME OF SAMPLE | | 79.3 | 127.1 | 86.4 |
| SPECIFIC GRAVITY | | 0.491 | 0.528 | 0.513 |

AVERAGE SPECIFIC GRAVITY: 0.511

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THE UNIVERSITY OF CHICAGO

IN THE DEPARTMENT OF CHEMISTRY

RESEARCH REPORT NO. 100

| DATE | ANALYST | ANALYST'S NO. | ANALYST'S NAME |
|------|---------|---------------|----------------|
| 1911 | 100 | 100 | 100 |
| 1912 | 100 | 100 | 100 |
| 1913 | 100 | 100 | 100 |
| 1914 | 100 | 100 | 100 |

RESEARCH REPORT NO. 100

| DATE | ANALYST | ANALYST'S NO. | ANALYST'S NAME |
|------|---------|---------------|----------------|
| 1911 | 100 | 100 | 100 |
| 1912 | 100 | 100 | 100 |
| 1913 | 100 | 100 | 100 |
| 1914 | 100 | 100 | 100 |
| 1915 | 100 | 100 | 100 |
| 1916 | 100 | 100 | 100 |
| 1917 | 100 | 100 | 100 |
| 1918 | 100 | 100 | 100 |
| 1919 | 100 | 100 | 100 |
| 1920 | 100 | 100 | 100 |
| 1921 | 100 | 100 | 100 |
| 1922 | 100 | 100 | 100 |
| 1923 | 100 | 100 | 100 |
| 1924 | 100 | 100 | 100 |
| 1925 | 100 | 100 | 100 |
| 1926 | 100 | 100 | 100 |
| 1927 | 100 | 100 | 100 |
| 1928 | 100 | 100 | 100 |
| 1929 | 100 | 100 | 100 |
| 1930 | 100 | 100 | 100 |
| 1931 | 100 | 100 | 100 |
| 1932 | 100 | 100 | 100 |
| 1933 | 100 | 100 | 100 |
| 1934 | 100 | 100 | 100 |
| 1935 | 100 | 100 | 100 |
| 1936 | 100 | 100 | 100 |
| 1937 | 100 | 100 | 100 |
| 1938 | 100 | 100 | 100 |
| 1939 | 100 | 100 | 100 |
| 1940 | 100 | 100 | 100 |
| 1941 | 100 | 100 | 100 |
| 1942 | 100 | 100 | 100 |
| 1943 | 100 | 100 | 100 |
| 1944 | 100 | 100 | 100 |
| 1945 | 100 | 100 | 100 |
| 1946 | 100 | 100 | 100 |
| 1947 | 100 | 100 | 100 |
| 1948 | 100 | 100 | 100 |
| 1949 | 100 | 100 | 100 |
| 1950 | 100 | 100 | 100 |
| 1951 | 100 | 100 | 100 |
| 1952 | 100 | 100 | 100 |
| 1953 | 100 | 100 | 100 |
| 1954 | 100 | 100 | 100 |
| 1955 | 100 | 100 | 100 |
| 1956 | 100 | 100 | 100 |
| 1957 | 100 | 100 | 100 |
| 1958 | 100 | 100 | 100 |
| 1959 | 100 | 100 | 100 |
| 1960 | 100 | 100 | 100 |
| 1961 | 100 | 100 | 100 |
| 1962 | 100 | 100 | 100 |
| 1963 | 100 | 100 | 100 |
| 1964 | 100 | 100 | 100 |
| 1965 | 100 | 100 | 100 |
| 1966 | 100 | 100 | 100 |
| 1967 | 100 | 100 | 100 |
| 1968 | 100 | 100 | 100 |
| 1969 | 100 | 100 | 100 |
| 1970 | 100 | 100 | 100 |
| 1971 | 100 | 100 | 100 |
| 1972 | 100 | 100 | 100 |
| 1973 | 100 | 100 | 100 |
| 1974 | 100 | 100 | 100 |
| 1975 | 100 | 100 | 100 |
| 1976 | 100 | 100 | 100 |
| 1977 | 100 | 100 | 100 |
| 1978 | 100 | 100 | 100 |
| 1979 | 100 | 100 | 100 |
| 1980 | 100 | 100 | 100 |
| 1981 | 100 | 100 | 100 |
| 1982 | 100 | 100 | 100 |
| 1983 | 100 | 100 | 100 |
| 1984 | 100 | 100 | 100 |
| 1985 | 100 | 100 | 100 |
| 1986 | 100 | 100 | 100 |
| 1987 | 100 | 100 | 100 |
| 1988 | 100 | 100 | 100 |
| 1989 | 100 | 100 | 100 |
| 1990 | 100 | 100 | 100 |
| 1991 | 100 | 100 | 100 |
| 1992 | 100 | 100 | 100 |
| 1993 | 100 | 100 | 100 |
| 1994 | 100 | 100 | 100 |
| 1995 | 100 | 100 | 100 |
| 1996 | 100 | 100 | 100 |
| 1997 | 100 | 100 | 100 |
| 1998 | 100 | 100 | 100 |
| 1999 | 100 | 100 | 100 |
| 2000 | 100 | 100 | 100 |
| 2001 | 100 | 100 | 100 |
| 2002 | 100 | 100 | 100 |
| 2003 | 100 | 100 | 100 |
| 2004 | 100 | 100 | 100 |
| 2005 | 100 | 100 | 100 |
| 2006 | 100 | 100 | 100 |
| 2007 | 100 | 100 | 100 |
| 2008 | 100 | 100 | 100 |
| 2009 | 100 | 100 | 100 |
| 2010 | 100 | 100 | 100 |
| 2011 | 100 | 100 | 100 |
| 2012 | 100 | 100 | 100 |
| 2013 | 100 | 100 | 100 |
| 2014 | 100 | 100 | 100 |
| 2015 | 100 | 100 | 100 |
| 2016 | 100 | 100 | 100 |
| 2017 | 100 | 100 | 100 |
| 2018 | 100 | 100 | 100 |
| 2019 | 100 | 100 | 100 |
| 2020 | 100 | 100 | 100 |
| 2021 | 100 | 100 | 100 |
| 2022 | 100 | 100 | 100 |
| 2023 | 100 | 100 | 100 |
| 2024 | 100 | 100 | 100 |
| 2025 | 100 | 100 | 100 |
| 2026 | 100 | 100 | 100 |
| 2027 | 100 | 100 | 100 |
| 2028 | 100 | 100 | 100 |
| 2029 | 100 | 100 | 100 |
| 2030 | 100 | 100 | 100 |
| 2031 | 100 | 100 | 100 |
| 2032 | 100 | 100 | 100 |
| 2033 | 100 | 100 | 100 |
| 2034 | 100 | 100 | 100 |
| 2035 | 100 | 100 | 100 |
| 2036 | 100 | 100 | 100 |
| 2037 | 100 | 100 | 100 |
| 2038 | 100 | 100 | 100 |
| 2039 | 100 | 100 | 100 |
| 2040 | 100 | 100 | 100 |
| 2041 | 100 | 100 | 100 |
| 2042 | 100 | 100 | 100 |
| 2043 | 100 | 100 | 100 |
| 2044 | 100 | 100 | 100 |
| 2045 | 100 | 100 | 100 |
| 2046 | 100 | 100 | 100 |
| 2047 | 100 | 100 | 100 |
| 2048 | 100 | 100 | 100 |
| 2049 | 100 | 100 | 100 |
| 2050 | 100 | 100 | 100 |
| 2051 | 100 | 100 | 100 |
| 2052 | 100 | 100 | 100 |
| 2053 | 100 | 100 | 100 |
| 2054 | 100 | 100 | 100 |
| 2055 | 100 | 100 | 100 |
| 2056 | 100 | 100 | 100 |
| 2057 | 100 | 100 | 100 |
| 2058 | 100 | 100 | 100 |
| 2059 | 100 | 100 | 100 |
| 2060 | 100 | 100 | 100 |
| 2061 | 100 | 100 | 100 |
| 2062 | 100 | 100 | 100 |
| 2063 | 100 | 100 | 100 |
| 2064 | 100 | 100 | 100 |
| 2065 | 100 | 100 | 100 |
| 2066 | 100 | 100 | 100 |
| 2067 | 100 | 100 | 100 |
| 2068 | 100 | 100 | 100 |
| 2069 | 100 | 100 | 100 |
| 2070 | 100 | 100 | 100 |
| 2071 | 100 | 100 | 100 |
| 2072 | 100 | 100 | 100 |
| 2073 | 100 | 100 | 100 |
| 2074 | 100 | 100 | 100 |
| 2075 | 100 | 100 | 100 |
| 2076 | 100 | 100 | 100 |
| 2077 | 100 | 100 | 100 |
| 2078 | 100 | 100 | 100 |
| 2079 | 100 | 100 | 100 |
| 2080 | 100 | 100 | 100 |
| 2081 | 100 | 100 | 100 |
| 2082 | 100 | 100 | 100 |
| 2083 | 100 | 100 | 100 |
| 2084 | 100 | 100 | 100 |
| 2085 | 100 | 100 | 100 |
| 2086 | 100 | 100 | 100 |
| 2087 | 100 | 100 | 100 |
| 2088 | 100 | 100 | 100 |
| 2089 | 100 | 100 | 100 |
| 2090 | 100 | 100 | 100 |
| 2091 | 100 | 100 | 100 |
| 2092 | 100 | 100 | 100 |
| 2093 | 100 | 100 | 100 |
| 2094 | 100 | 100 | 100 |
| 2095 | 100 | 100 | 100 |
| 2096 | 100 | 100 | 100 |
| 2097 | 100 | 100 | 100 |
| 2098 | 100 | 100 | 100 |
| 2099 | 100 | 100 | 100 |
| 2100 | 100 | 100 | 100 |

RESEARCH REPORT NO. 100

RESEARCH REPORT NO. 100

RESEARCH REPORT NO. 100

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-13 DATE TESTED: Sept. 16, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 43.70 | 71.67 | 49.53 |
| DRY WEIGHT | 40.07 | 65.10 | 45.37 |
| WEIGHT OF WATER | 3.63 | 6.57 | 4.16 |
| MOISTURE CONTENT (%) | 9.1 | 10.1 | 9.2 |

AVERAGE MOISTURE CONTENT: 9.5%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 42.85 | 69.50 | 48.75 |
| DRY WEIGHT | | 40.07 | 65.10 | 45.37 |
| WEIGHT OF PARAFFIN | | 2.78 | 4.40 | 3.38 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 90 | 129 | 103 |
| | 2 | 90 | 128 | 103 |
| | 3 | 90 | 128 | 103 |
| | SUM | | 385 | |
| | AVERAGE | 90.0 | 128.3 | 103.0 |
| *VOLUME OF PARAFFIN | | 3.1 | 4.9 | 3.8 |
| VOLUME OF SAMPLE | | 86.9 | 123.4 | 99.2 |
| SPECIFIC GRAVITY | | 0.462 | 0.528 | 0.457 |

AVERAGE SPECIFIC GRAVITY: 0.482

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-14 DATE TESTED: Sept. 16, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 63.46 | 77.30 | 56.48 |
| DRY WEIGHT | 58.57 | 70.34 | 52.18 |
| WEIGHT OF WATER | 4.89 | 6.96 | 4.30 |
| MOISTURE CONTENT (%) | 8.4 | 9.9 | 8.2 |

AVERAGE MOISTURE CONTENT: 8.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 63.21 | 74.00 | 56.78 |
| DRY WEIGHT | | 58.57 | 70.34 | 52.18 |
| WEIGHT OF PARAFFIN | | 4.64 | 3.66 | 4.60 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 114 | 135 | 103 |
| | 2 | 114 | 135 | 103 |
| | 3 | 114 | 135 | 103 |
| | SUM | | | |
| | AVERAGE | 114.0 | 135.0 | 103.0 |
| *VOLUME OF PARAFFIN | | 5.2 | 4.1 | 5.2 |
| VOLUME OF SAMPLE | | 108.8 | 130.9 | 97.8 |
| SPECIFIC GRAVITY | | 0.540 | 0.538 | 0.534 |

AVERAGE SPECIFIC GRAVITY: 0.537

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE I
Summary of the results of the experiments

The following table gives a summary of the results of the experiments conducted during the period from 1st January to 31st December 1955.

| Experiment No. | Date | Time of day | Weather | Remarks |
|----------------|--------|-------------|---------|-------------------|
| 1 | 1.1.55 | 10.00 | Sunny | First experiment |
| 2 | 2.1.55 | 11.00 | Cloudy | Second experiment |
| 3 | 3.1.55 | 12.00 | Sunny | Third experiment |
| 4 | 4.1.55 | 13.00 | Sunny | Fourth experiment |
| 5 | 5.1.55 | 14.00 | Sunny | Fifth experiment |

The results of the experiments are given in the following table.

| Experiment No. | Date | Time of day | Weather | Remarks |
|----------------|---------|-------------|---------|-----------------------|
| 6 | 6.1.55 | 15.00 | Sunny | Sixth experiment |
| 7 | 7.1.55 | 16.00 | Sunny | Seventh experiment |
| 8 | 8.1.55 | 17.00 | Sunny | Eighth experiment |
| 9 | 9.1.55 | 18.00 | Sunny | Ninth experiment |
| 10 | 10.1.55 | 19.00 | Sunny | Tenth experiment |
| 11 | 11.1.55 | 20.00 | Sunny | Eleventh experiment |
| 12 | 12.1.55 | 21.00 | Sunny | Twelfth experiment |
| 13 | 13.1.55 | 22.00 | Sunny | Thirteenth experiment |
| 14 | 14.1.55 | 23.00 | Sunny | Fourteenth experiment |
| 15 | 15.1.55 | 24.00 | Sunny | Fifteenth experiment |

The results of the experiments are given in the following table.

The results of the experiments are given in the following table.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: C-15 DATE TESTED: Sept. 16, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 43.49 | 76.40 | 53.18 |
| DRY WEIGHT | 40.45 | 69.53 | 49.23 |
| WEIGHT OF WATER | 3.04 | 6.87 | 3.95 |
| MOISTURE CONTENT (%) | 7.5 | 9.9 | 8.0 |

AVERAGE MOISTURE CONTENT: 8.5%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 44.71 | 72.88 | 52.44 |
| DRY WEIGHT | | 40.45 | 69.53 | 49.23 |
| WEIGHT OF PARAFFIN | | 4.26 | 3.35 | 3.21 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 89 | 132 | 96 |
| | 2 | 89 | 132 | 96 |
| | NUMBER 3 | 89 | 131 | 95 |
| | SUM | | 395 | 287 |
| | AVERAGE | 89.0 | 131.7 | 95.7 |
| *VOLUME OF PARAFFIN | | 4.8 | 3.8 | 3.6 |
| VOLUME OF SAMPLE | | 84.2 | 127.9 | 92.1 |
| SPECIFIC GRAVITY | | 0.480 | 0.545 | 0.534 |

AVERAGE SPECIFIC GRAVITY: 0.520

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-1 DATE TESTED: Sept. 16, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 53.78 | 62.84 | 41.07 |
| DRY WEIGHT | 49.38 | 57.37 | 37.74 |
| WEIGHT OF WATER | 4.40 | 5.47 | 3.33 |
| MOISTURE CONTENT (%) | 8.9 | 9.5 | 8.8 |

AVERAGE MOISTURE CONTENT: 9.1%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 52.17 | 61.31 | 40.27 |
| DRY WEIGHT | | 49.38 | 57.37 | 37.74 |
| WEIGHT OF PARAFFIN | | 2.79 | 3.94 | 2.53 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 97 | 126 | 85 |
| | 2 | 97 | 128 | 84 |
| | 3 | 98 | 128 | 84 |
| | SUM | 292 | 382 | 253 |
| | AVERAGE | 97.3 | 127.3 | 84.3 |
| *VOLUME OF PARAFFIN | | 3.1 | 4.4 | 2.8 |
| VOLUME OF SAMPLE | | 94.2 | 122.9 | 81.5 |
| SPECIFIC GRAVITY | | 0.524 | 0.467 | 0.463 |

AVERAGE SPECIFIC GRAVITY: 0.485

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THE UNIVERSITY OF CHICAGO

DEPARTMENT OF CHEMISTRY

RESEARCH REPORT NO. 1000

| DATE | BY | TO | REMARKS |
|---------|--------------|--------------|---------|
| 10/1/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/2/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/3/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/4/50 | J. H. DILLON | W. R. HARRIS | 1000 |

1000

| DATE | BY | TO | REMARKS |
|----------|--------------|--------------|---------|
| 10/1/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/2/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/3/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/4/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/5/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/6/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/7/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/8/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/9/50 | J. H. DILLON | W. R. HARRIS | 1000 |
| 10/10/50 | J. H. DILLON | W. R. HARRIS | 1000 |

1000

1000

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-2 DATE TESTED: Sept. 16, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 51.19 | 84.88 | 45.32 |
| DRY WEIGHT | 47.07 | 77.22 | 41.57 |
| WEIGHT OF WATER | 4.12 | 7.66 | 3.75 |
| MOISTURE CONTENT (%) | 8.7 | 9.9 | 9.0 |

AVERAGE MOISTURE CONTENT: 9.2%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 50.15 | 81.95 | 44.33 |
| DRY WEIGHT | | 47.07 | 77.22 | 41.57 |
| WEIGHT OF PARAFFIN | | 3.08 | 4.73 | 2.76 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 105 | 148 | 93 |
| | 2 | 106 | 150 | 92 |
| | 3 | 106 | 149 | 92 |
| | SUM | 317 | 447 | 277 |
| | AVERAGE | 105.7 | 149.0 | 92.3 |
| *VOLUME OF PARAFFIN | | 3.5 | 5.3 | 3.1 |
| VOLUME OF SAMPLE | | 102.2 | 143.7 | 89.2 |
| SPECIFIC GRAVITY | | 0.460 | 0.538 | 0.466 |

AVERAGE SPECIFIC GRAVITY: 0.488

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

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DATE OF ACQUISITION

DATE OF ACQUISITION

| DATE | FROM | TO | REMARKS |
|------|------|------|---------|
| 1950 | 1951 | 1952 | 1953 |
| 1954 | 1955 | 1956 | 1957 |
| 1958 | 1959 | 1960 | 1961 |
| 1962 | 1963 | 1964 | 1965 |

DATE OF ACQUISITION

| DATE | FROM | TO | REMARKS |
|------|------|------|---------|
| 1966 | 1967 | 1968 | 1969 |
| 1970 | 1971 | 1972 | 1973 |
| 1974 | 1975 | 1976 | 1977 |
| 1978 | 1979 | 1980 | 1981 |
| 1982 | 1983 | 1984 | 1985 |
| 1986 | 1987 | 1988 | 1989 |
| 1990 | 1991 | 1992 | 1993 |
| 1994 | 1995 | 1996 | 1997 |
| 1998 | 1999 | 2000 | 2001 |
| 2002 | 2003 | 2004 | 2005 |
| 2006 | 2007 | 2008 | 2009 |
| 2010 | 2011 | 2012 | 2013 |
| 2014 | 2015 | 2016 | 2017 |
| 2018 | 2019 | 2020 | 2021 |
| 2022 | 2023 | 2024 | 2025 |

DATE OF ACQUISITION

DATE OF ACQUISITION

DATE OF ACQUISITION

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-3 DATE TESTED: Sept. 16, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 54.63 | 74.10 | 42.28 |
| DRY WEIGHT | 50.12 | 67.32 | 38.74 |
| WEIGHT OF WATER | 4.51 | 6.78 | 3.54 |
| MOISTURE CONTENT (%) | 9.0 | 10.1 | 9.1 |

AVERAGE MOISTURE CONTENT: 9.4%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 52.97 | 71.96 | 41.47 |
| DRY WEIGHT | | 50.12 | 67.32 | 38.74 |
| WEIGHT OF PARAFFIN | | 2.85 | 4.64 | 2.73 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 112 | 134 | 85 |
| | 2 | 112 | 134 | 85 |
| | 3 | 112 | 134 | 85 |
| | SUM | | | |
| | AVERAGE | 112.0 | 134.0 | 85.0 |
| *VOLUME OF PARAFFIN | | 3.2 | 5.2 | 3.1 |
| VOLUME OF SAMPLE | | 108.8 | 128.8 | 81.9 |
| SPECIFIC GRAVITY | | 0.461 | 0.523 | 0.473 |

AVERAGE SPECIFIC GRAVITY: 0.486

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-4 DATE TESTED: Sept. 17, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 50.82 | 71.00 | 42.94 |
| DRY WEIGHT | 46.65 | 64.47 | 39.40 |
| WEIGHT OF WATER | 4.17 | 6.53 | 3.54 |
| MOISTURE CONTENT (%) | 8.9 | 10.1 | 9.0 |

AVERAGE MOISTURE CONTENT: 9.3%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 52.20 | 71.07 | 44.33 |
| DRY WEIGHT | | 46.65 | 64.47 | 39.40 |
| WEIGHT OF PARAFFIN | | 5.55 | 6.60 | 4.93 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 106 | 130 | 81 |
| | 2 | 106 | 129 | 81 |
| | NUMBER 3 | 106 | 129 | 81 |
| | SUM | | 388 | |
| | AVERAGE | 106.0 | 129.3 | 81.0 |
| *VOLUME OF PARAFFIN | | 6.2 | 7.4 | 5.5 |
| VOLUME OF SAMPLE | | 99.8 | 121.9 | 75.5 |
| SPECIFIC GRAVITY | | 0.468 | 0.528 | 0.522 |

AVERAGE SPECIFIC GRAVITY: 0.506

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THEORY OF THE EARTH

CHAPTER I. OF THE ORIGIN AND EXTENSION OF THE EARTH.

| Time | Distance | Velocity | Force |
|------|----------|----------|-------|
| 1.00 | 10.00 | 10.00 | 10.00 |
| 2.00 | 20.00 | 20.00 | 20.00 |
| 3.00 | 30.00 | 30.00 | 30.00 |
| 4.00 | 40.00 | 40.00 | 40.00 |

CHAPTER II. OF THE NATURE AND PROPERTIES OF THE EARTH.

| Time | Distance | Velocity | Force |
|-------|----------|----------|--------|
| 1.00 | 10.00 | 10.00 | 10.00 |
| 2.00 | 20.00 | 20.00 | 20.00 |
| 3.00 | 30.00 | 30.00 | 30.00 |
| 4.00 | 40.00 | 40.00 | 40.00 |
| 5.00 | 50.00 | 50.00 | 50.00 |
| 6.00 | 60.00 | 60.00 | 60.00 |
| 7.00 | 70.00 | 70.00 | 70.00 |
| 8.00 | 80.00 | 80.00 | 80.00 |
| 9.00 | 90.00 | 90.00 | 90.00 |
| 10.00 | 100.00 | 100.00 | 100.00 |

CHAPTER III. OF THE USES AND APPLICATIONS OF THE EARTH.

CHAPTER IV. OF THE HISTORY AND PROGRESS OF THE EARTH.

CHAPTER V. OF THE FUTURE OF THE EARTH.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-5 DATE TESTED: Sept. 17, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 47.70 | 59.18 | 39.56 |
| DRY WEIGHT | 43.92 | 53.95 | 36.47 |
| WEIGHT OF WATER | 3.78 | 5.23 | 3.09 |
| MOISTURE CONTENT (%) | 8.6 | 9.7 | 8.5 |

AVERAGE MOISTURE CONTENT: 8.9%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 49.68 | 60.12 | 41.37 |
| DRY WEIGHT | | 43.92 | 53.95 | 36.47 |
| WEIGHT OF PARAFFIN | | 5.76 | 6.17 | 4.90 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 107 | 126 | 88 |
| | 2 | 107 | 125 | 88 |
| | 3 | 107 | 126 | 88 |
| | SUM | | 377 | |
| | AVERAGE | 107.0 | 125.7 | 88.0 |
| *VOLUME OF PARAFFIN | | 6.5 | 6.9 | 5.5 |
| VOLUME OF SAMPLE | | 100.5 | 118.8 | 82.5 |
| SPECIFIC GRAVITY | | 0.437 | 0.454 | 0.442 |

AVERAGE SPECIFIC GRAVITY: 0.444

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

ANNUAL REPORT OF THE
COMMISSIONER OF THE LAND OFFICE

FOR THE YEAR ENDING 1890

| LANDS BELONGING TO THE UNITED STATES | | | |
|--------------------------------------|----------|-------|--------|
| SECTION | TOWNSHIP | RANGE | COUNTY |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |

LANDS BELONGING TO THE STATE OF CALIFORNIA

| SECTION | TOWNSHIP | RANGE | COUNTY |
|---------|----------|-------|--------|
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 |
| 10 | 10 | 10 | 10 |

LANDS BELONGING TO THE COUNTY OF SAN JOAQUIN

FOR THE YEAR ENDING 1890

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-6 DATE TESTED: Sept. 17, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 45.22 | 76.93 | 54.67 |
| DRY WEIGHT | 41.58 | 69.76 | 50.04 |
| WEIGHT OF WATER | 3.64 | 7.17 | 4.63 |
| MOISTURE CONTENT (%) | 8.7 | 10.3 | 9.3 |

AVERAGE MOISTURE CONTENT: 9.4%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 46.45 | 75.78 | 54.91 |
| DRY WEIGHT | | 41.58 | 69.76 | 50.04 |
| WEIGHT OF PARAFFIN | | 4.87 | 6.02 | 4.87 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 95 | 125 | 95 |
| | 2 | 95 | 125 | 95 |
| | 3 | 96 | 125 | 95 |
| | SUM | 286 | | |
| | AVERAGE | 95.3 | 125.0 | 95.0 |
| *VOLUME OF PARAFFIN | | 5.5 | 6.7 | 5.5 |
| VOLUME OF SAMPLE | | 89.8 | 118.3 | 89.5 |
| SPECIFIC GRAVITY | | 0.464 | 0.589 | 0.560 |

AVERAGE SPECIFIC GRAVITY: 0.538

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THEORY OF THE EARTH

CHAPTER I. OF THE ORIGIN AND GROWTH OF THE EARTH.

SECTION I. OF THE ORIGIN OF THE EARTH.

| Time | State of the Earth | Temperature | State of the Atmosphere |
|------|--------------------|-------------|-------------------------|
| 1. 0 | 1. 0 | 1. 0 | 1. 0 |
| 2. 0 | 2. 0 | 2. 0 | 2. 0 |
| 3. 0 | 3. 0 | 3. 0 | 3. 0 |
| 4. 0 | 4. 0 | 4. 0 | 4. 0 |

SECTION II.

| Time | State of the Earth | Temperature | State of the Atmosphere |
|-------|--------------------|-------------|-------------------------|
| 1. 0 | 1. 0 | 1. 0 | 1. 0 |
| 2. 0 | 2. 0 | 2. 0 | 2. 0 |
| 3. 0 | 3. 0 | 3. 0 | 3. 0 |
| 4. 0 | 4. 0 | 4. 0 | 4. 0 |
| 5. 0 | 5. 0 | 5. 0 | 5. 0 |
| 6. 0 | 6. 0 | 6. 0 | 6. 0 |
| 7. 0 | 7. 0 | 7. 0 | 7. 0 |
| 8. 0 | 8. 0 | 8. 0 | 8. 0 |
| 9. 0 | 9. 0 | 9. 0 | 9. 0 |
| 10. 0 | 10. 0 | 10. 0 | 10. 0 |

SECTION III.

OF THE GROWTH OF THE EARTH.

THEORY OF THE EARTH.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-7 DATE TESTED: Sept. 17, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 55.08 | 89.48 | 54.14 |
| DRY WEIGHT | 50.50 | 81.18 | 49.63 |
| WEIGHT OF WATER | 4.58 | 8.30 | 4.51 |
| MOISTURE CONTENT (%) | 9.1 | 10.2 | 9.1 |

AVERAGE MOISTURE CONTENT: 9.5%

| | | | | |
|---|----------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 55.70 | 87.25 | 54.78 |
| DRY WEIGHT | | 50.50 | 81.18 | 49.63 |
| WEIGHT OF PARAFFIN | | 5.20 | 6.07 | 5.15 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 96 | 144 | 96 |
| | 2 | 97 | 144 | 96 |
| | NUMBER 3 | 97 | 144 | 97 |
| | SUM | 290 | | 289 |
| | AVERAGE | 96.7 | 144.0 | 96.3 |
| *VOLUME OF PARAFFIN | | 5.8 | 6.8 | 5.8 |
| VOLUME OF SAMPLE | | 90.9 | 137.2 | 90.5 |
| SPECIFIC GRAVITY | | 0.556 | 0.591 | 0.549 |

AVERAGE SPECIFIC GRAVITY: 0.565

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

ANNUAL REPORT OF THE COMMISSIONER OF THE LAND OFFICE

FOR THE YEAR ENDING 1900

ALBANY, N. Y.: J. B. LIPPINCOTT & CO., PRINTERS, 1901.

| LANDS | PAID FOR | PAID FOR | PAID FOR |
|-------|----------|----------|----------|
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |

ALBANY, N. Y.: J. B. LIPPINCOTT & CO., PRINTERS, 1901.

| LANDS | PAID FOR | PAID FOR | PAID FOR |
|-------|----------|----------|----------|
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |
| 1000 | 1000 | 1000 | 1000 |

ALBANY, N. Y.: J. B. LIPPINCOTT & CO., PRINTERS, 1901.

ALBANY, N. Y.: J. B. LIPPINCOTT & CO., PRINTERS, 1901.

ALBANY, N. Y.: J. B. LIPPINCOTT & CO., PRINTERS, 1901.

University of Alberta
 Dept. of Civil Engineering

BOLTED JOINT TESTS
 MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-8 DATE TESTED: Sept. 17, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 50.32 | 75.57 | 46.48 |
| DRY WEIGHT | 46.30 | 68.50 | 42.80 |
| WEIGHT OF WATER | 4.02 | 7.07 | 3.68 |
| MOISTURE CONTENT (%) | 8.7 | 10.3 | 8.6 |

AVERAGE MOISTURE CONTENT: 9.2%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 51.78 | 74.46 | 50.20 |
| DRY WEIGHT | | 46.30 | 68.50 | 42.80 |
| WEIGHT OF PARAFFIN | | 5.48 | 5.96 | 7.40 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 107 | 125 | 104 |
| | 2 | 107 | 124 | 104 |
| | 3 | 106 | 126 | 104 |
| | SUM | 320 | 375 | |
| | AVERAGE | 106.7 | 125.0 | 104.0 |
| *VOLUME OF PARAFFIN | | 6.1 | 6.7 | 8.3 |
| VOLUME OF SAMPLE | | 100.6 | 118.3 | 95.7 |
| SPECIFIC GRAVITY | | 0.460 | 0.578 | 0.448 |

AVERAGE SPECIFIC GRAVITY: 0.495

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
 ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE I
Summary of the results of the experiments on the effect of the concentration of the solution on the rate of the reaction

| Concentration of the solution (M) | Rate of the reaction (mol/lit. sec) | Time (sec) | Volume of the solution (lit.) |
|-----------------------------------|-------------------------------------|------------|-------------------------------|
| 0.1 | 0.001 | 100 | 1.0 |
| 0.2 | 0.002 | 50 | 1.0 |
| 0.3 | 0.003 | 33 | 1.0 |
| 0.4 | 0.004 | 25 | 1.0 |
| 0.5 | 0.005 | 20 | 1.0 |

Notes: The rate of the reaction was determined by the method of the initial rates.

| Concentration of the solution (M) | Rate of the reaction (mol/lit. sec) | Time (sec) | Volume of the solution (lit.) |
|-----------------------------------|-------------------------------------|------------|-------------------------------|
| 0.1 | 0.001 | 100 | 1.0 |
| 0.2 | 0.002 | 50 | 1.0 |
| 0.3 | 0.003 | 33 | 1.0 |
| 0.4 | 0.004 | 25 | 1.0 |
| 0.5 | 0.005 | 20 | 1.0 |
| 0.6 | 0.006 | 16.7 | 1.0 |
| 0.7 | 0.007 | 14.3 | 1.0 |
| 0.8 | 0.008 | 12.5 | 1.0 |
| 0.9 | 0.009 | 11.1 | 1.0 |
| 1.0 | 0.010 | 10.0 | 1.0 |

Notes: The rate of the reaction was determined by the method of the initial rates.

The results of the experiments show that the rate of the reaction increases with the increase of the concentration of the solution.

The rate of the reaction is directly proportional to the concentration of the solution.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-9 DATE TESTED: Sept. 17, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 47.78 | 52.55 | 47.58 |
| DRY WEIGHT | 43.87 | 47.95 | 43.73 |
| WEIGHT OF WATER | 3.91 | 4.60 | 3.85 |
| MOISTURE CONTENT (%) | 8.9 | 9.6 | 8.8 |

AVERAGE MOISTURE CONTENT: 9.1%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 49.15 | 54.00 | 49.30 |
| DRY WEIGHT | | 43.87 | 47.95 | 43.73 |
| WEIGHT OF PARAFFIN | | 5.28 | 6.05 | 5.57 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 95 | 112 | 96 |
| | 2 | 95 | 111 | 96 |
| | 3 | 96 | 112 | 96 |
| | SUM | 286 | 335 | |
| | AVERAGE | 95.3 | 111.7 | 96.0 |
| *VOLUME OF PARAFFIN | | 5.9 | 6.8 | 6.2 |
| VOLUME OF SAMPLE | | 89.4 | 104.9 | 89.8 |
| SPECIFIC GRAVITY | | 0.491 | 0.457 | 0.488 |

AVERAGE SPECIFIC GRAVITY: 0.479

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE 1. Summary of the results of the 1991-1992 survey of the distribution of the common carp in the Great Lakes.

Common carp (Cyprinus carpio) in the Great Lakes, 1991-1992.

1. Summary of the results of the 1991-1992 survey of the distribution of the common carp in the Great Lakes.

| Year | 1991 | 1992 | Total |
|------|------|------|-------|
| 1991 | 10.0 | 10.0 | 20.0 |
| 1992 | 10.0 | 10.0 | 20.0 |
| 1993 | 10.0 | 10.0 | 20.0 |
| 1994 | 10.0 | 10.0 | 20.0 |

2. Summary of the results of the 1991-1992 survey of the distribution of the common carp in the Great Lakes.

| Year | 1991 | 1992 | Total |
|------|------|------|-------|
| 1991 | 10.0 | 10.0 | 20.0 |
| 1992 | 10.0 | 10.0 | 20.0 |
| 1993 | 10.0 | 10.0 | 20.0 |
| 1994 | 10.0 | 10.0 | 20.0 |
| 1995 | 10.0 | 10.0 | 20.0 |
| 1996 | 10.0 | 10.0 | 20.0 |
| 1997 | 10.0 | 10.0 | 20.0 |
| 1998 | 10.0 | 10.0 | 20.0 |
| 1999 | 10.0 | 10.0 | 20.0 |
| 2000 | 10.0 | 10.0 | 20.0 |

3. Summary of the results of the 1991-1992 survey of the distribution of the common carp in the Great Lakes.

4. Summary of the results of the 1991-1992 survey of the distribution of the common carp in the Great Lakes.

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-10 DATE TESTED: Sept. 18, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 48.23 | 67.51 | 48.17 |
| DRY WEIGHT | 44.20 | 61.34 | 44.17 |
| WEIGHT OF WATER | 4.03 | 6.17 | 4.00 |
| MOISTURE CONTENT (%) | 9.1 | 10.1 | 9.1 |

AVERAGE MOISTURE CONTENT: 9.4%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 47.74 | 65.80 | 47.68 |
| DRY WEIGHT | | 44.20 | 61.34 | 44.17 |
| WEIGHT OF PARAFFIN | | 3.54 | 4.46 | 3.51 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 98 | 123 | 98 |
| | 2 | 98 | 121 | 98 |
| | 3 | 98 | 121 | 98 |
| | SUM | | 365 | |
| | AVERAGE | 98.0 | 121.7 | 98.0 |
| *VOLUME OF PARAFFIN | | 4.0 | 5.0 | 3.9 |
| VOLUME OF SAMPLE | | 94.0 | 116.7 | 94.1 |
| SPECIFIC GRAVITY | | 0.470 | 0.526 | 0.469 |

AVERAGE SPECIFIC GRAVITY: 0.488

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-11 DATE TESTED: Sept. 18, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 48.78 | 61.97 | 42.40 |
| DRY WEIGHT | 45.00 | 56.53 | 39.07 |
| WEIGHT OF WATER | 3.78 | 5.44 | 3.33 |
| MOISTURE CONTENT (%) | 8.4 | 9.6 | 8.5 |

AVERAGE MOISTURE CONTENT: 8.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 48.99 | 61.31 | 42.39 |
| DRY WEIGHT | | 45.00 | 56.53 | 39.07 |
| WEIGHT OF PARAFFIN | | 3.99 | 4.78 | 3.32 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 105 | 128 | 90 |
| | 2 | 104 | 128 | 90 |
| | 3 | 104 | 128 | 89 |
| | SUM | 313 | | 269 |
| | AVERAGE | 104.3 | 128.0 | 89.7 |
| *VOLUME OF PARAFFIN | | 4.5 | 5.4 | 3.7 |
| VOLUME OF SAMPLE | | 99.8 | 122.6 | 86.0 |
| SPECIFIC GRAVITY | | 0.451 | 0.462 | 0.455 |

AVERAGE SPECIFIC GRAVITY: 0.456

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS ³

ANNUAL REPORT OF THE COMMISSIONER OF THE LAND OFFICE

FOR THE YEAR ENDING 1890

ALBANY, N. Y., 1891

| DATE | AMOUNT | RECEIPTS | PAID |
|-------|--------|----------|------|
| Jan 1 | 10.00 | 10.00 | |
| Feb 1 | 10.00 | 10.00 | |
| Mar 1 | 10.00 | 10.00 | |
| Apr 1 | 10.00 | 10.00 | |
| May 1 | 10.00 | 10.00 | |
| Jun 1 | 10.00 | 10.00 | |
| Jul 1 | 10.00 | 10.00 | |
| Aug 1 | 10.00 | 10.00 | |
| Sep 1 | 10.00 | 10.00 | |
| Oct 1 | 10.00 | 10.00 | |
| Nov 1 | 10.00 | 10.00 | |
| Dec 1 | 10.00 | 10.00 | |

THE COMMISSIONER OF THE LAND OFFICE

| DATE | AMOUNT | RECEIPTS | PAID |
|-------|--------|----------|------|
| Jan 1 | 10.00 | 10.00 | |
| Feb 1 | 10.00 | 10.00 | |
| Mar 1 | 10.00 | 10.00 | |
| Apr 1 | 10.00 | 10.00 | |
| May 1 | 10.00 | 10.00 | |
| Jun 1 | 10.00 | 10.00 | |
| Jul 1 | 10.00 | 10.00 | |
| Aug 1 | 10.00 | 10.00 | |
| Sep 1 | 10.00 | 10.00 | |
| Oct 1 | 10.00 | 10.00 | |
| Nov 1 | 10.00 | 10.00 | |
| Dec 1 | 10.00 | 10.00 | |
| Jan 1 | 10.00 | 10.00 | |
| Feb 1 | 10.00 | 10.00 | |
| Mar 1 | 10.00 | 10.00 | |
| Apr 1 | 10.00 | 10.00 | |
| May 1 | 10.00 | 10.00 | |
| Jun 1 | 10.00 | 10.00 | |
| Jul 1 | 10.00 | 10.00 | |
| Aug 1 | 10.00 | 10.00 | |
| Sep 1 | 10.00 | 10.00 | |
| Oct 1 | 10.00 | 10.00 | |
| Nov 1 | 10.00 | 10.00 | |
| Dec 1 | 10.00 | 10.00 | |

THE COMMISSIONER OF THE LAND OFFICE

ALBANY, N. Y., 1891

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-12 DATE TESTED: Sept. 18, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 42.38 | 77.33 | 48.81 |
| DRY WEIGHT | 38.93 | 70.30 | 44.80 |
| WEIGHT OF WATER | 3.45 | 7.03 | 4.01 |
| MOISTURE CONTENT (%) | 8.9 | 10.0 | 9.0 |

AVERAGE MOISTURE CONTENT: 9.3%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 41.95 | 74.78 | 48.23 |
| DRY WEIGHT | | 38.93 | 70.30 | 44.80 |
| WEIGHT OF PARAFFIN | | 3.02 | 4.48 | 3.43 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 89 | 130 | 103 |
| | 2 | 89 | 131 | 104 |
| | 3 | 89 | 131 | 104 |
| | SUM | | 392 | 311 |
| | AVERAGE | 89.0 | 130.7 | 103.7 |
| *VOLUME OF PARAFFIN | | 3.4 | 5.0 | 3.8 |
| VOLUME OF SAMPLE | | 85.6 | 125.7 | 99.9 |
| SPECIFIC GRAVITY | | 0.454 | 0.560 | 0.449 |

AVERAGE SPECIFIC GRAVITY: 0.488

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

TABLE 1. - SUMMARY OF DATA FOR THE
FISH AND WILDLIFE COMMISSION

FOR THE YEAR 1964

UNITED STATES DEPARTMENT OF THE INTERIOR

| STATE | NO. OF FISH | NO. OF WILDLIFE | TOTAL |
|----------|-------------|-----------------|-------|
| ALABAMA | 100 | 200 | 300 |
| ALASKA | 50 | 100 | 150 |
| ARIZONA | 20 | 40 | 60 |
| ARKANSAS | 30 | 60 | 90 |

TABLE 2

| STATE | NO. OF FISH | NO. OF WILDLIFE | TOTAL |
|----------------|-------------|-----------------|-------|
| CALIFORNIA | 150 | 300 | 450 |
| COLORADO | 40 | 80 | 120 |
| CONNECTICUT | 10 | 20 | 30 |
| DELAWARE | 5 | 10 | 15 |
| FLORIDA | 80 | 160 | 240 |
| GEORGIA | 60 | 120 | 180 |
| IDAHO | 20 | 40 | 60 |
| ILLINOIS | 30 | 60 | 90 |
| INDIANA | 25 | 50 | 75 |
| IOWA | 15 | 30 | 45 |
| KANSAS | 10 | 20 | 30 |
| KENTUCKY | 20 | 40 | 60 |
| LOUISIANA | 40 | 80 | 120 |
| MAINE | 5 | 10 | 15 |
| MARYLAND | 10 | 20 | 30 |
| MASSACHUSETTS | 5 | 10 | 15 |
| MICHIGAN | 30 | 60 | 90 |
| MINNESOTA | 20 | 40 | 60 |
| MISSISSIPPI | 30 | 60 | 90 |
| MISSOURI | 15 | 30 | 45 |
| MONTANA | 10 | 20 | 30 |
| NEBRASKA | 10 | 20 | 30 |
| NEVADA | 5 | 10 | 15 |
| NEW HAMPSHIRE | 5 | 10 | 15 |
| NEW JERSEY | 10 | 20 | 30 |
| NEW YORK | 20 | 40 | 60 |
| NORTH CAROLINA | 30 | 60 | 90 |
| NORTH DAKOTA | 10 | 20 | 30 |
| OHIO | 20 | 40 | 60 |
| OKLAHOMA | 10 | 20 | 30 |
| OREGON | 10 | 20 | 30 |
| PENNSYLVANIA | 10 | 20 | 30 |
| RHODE ISLAND | 5 | 10 | 15 |
| SOUTH CAROLINA | 20 | 40 | 60 |
| SOUTH DAKOTA | 10 | 20 | 30 |
| TENNESSEE | 20 | 40 | 60 |
| TEXAS | 40 | 80 | 120 |
| UTAH | 10 | 20 | 30 |
| Vermont | 5 | 10 | 15 |
| VIRGINIA | 10 | 20 | 30 |
| WASHINGTON | 10 | 20 | 30 |
| WEST VIRGINIA | 5 | 10 | 15 |
| WISCONSIN | 20 | 40 | 60 |
| WYOMING | 10 | 20 | 30 |

TABLE 3

UNITED STATES DEPARTMENT OF THE INTERIOR

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-13 DATE TESTED: Sept. 18, 1959.

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 45.82 | 59.07 | 52.97 |
| DRY WEIGHT | 42.20 | 53.99 | 48.81 |
| WEIGHT OF WATER | 3.62 | 5.08 | 4.16 |
| MOISTURE CONTENT (%) | 8.6 | 9.4 | 8.5 |

AVERAGE MOISTURE CONTENT: 8.8%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 45.68 | 58.41 | 52.43 |
| DRY WEIGHT | | 42.20 | 53.99 | 48.81 |
| WEIGHT OF PARAFFIN | | 3.48 | 4.42 | 3.62 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 99 | 129 | 113 |
| | 2 | 98 | 129 | 113 |
| | 3 | 98 | 129 | 113 |
| | SUM | 295 | | |
| | AVERAGE | 98.3 | 129.0 | 113.0 |
| *VOLUME OF PARAFFIN | | 3.9 | 5.0 | 4.1 |
| VOLUME OF SAMPLE | | 94.4 | 124.0 | 108.9 |
| SPECIFIC GRAVITY | | 0.448 | 0.435 | 0.448 |

AVERAGE SPECIFIC GRAVITY: 0.444

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS ³

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University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-14 DATE TESTED: Sept. 18, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 46.53 | 78.92 | 51.99 |
| DRY WEIGHT | 43.11 | 71.79 | 48.24 |
| WEIGHT OF WATER | 3.42 | 7.13 | 3.75 |
| MOISTURE CONTENT (%) | 7.9 | 9.9 | 7.8 |

AVERAGE MOISTURE CONTENT: 8.5%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 47.58 | 75.88 | 53.04 |
| DRY WEIGHT | | 43.11 | 71.79 | 48.24 |
| WEIGHT OF PARAFFIN | | 4.47 | 4.09 | 4.80 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 95 | 136 | 105 |
| | 2 | 95 | 136 | 105 |
| | 3 | 96 | 136 | 105 |
| | SUM | 286 | | |
| | AVERAGE | 95.3 | 136.0 | 105.0 |
| *VOLUME OF PARAFFIN | | 5.0 | 4.6 | 5.4 |
| VOLUME OF SAMPLE | | 90.3 | 131.4 | 99.6 |
| SPECIFIC GRAVITY | | 0.478 | 0.546 | 0.485 |

AVERAGE SPECIFIC GRAVITY: 0.503

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

THE UNIVERSITY OF CHICAGO

OFFICE OF THE DEAN OF STUDENTS
 540 EAST 58TH STREET, CHICAGO, ILL. 60637

NAME _____ ADDRESS _____

| NAME | ADDRESS | CITY | STATE |
|------|---------|---------|-------|
| JOHN | 1234 | CHICAGO | ILL. |
| JANE | 5678 | CHICAGO | ILL. |
| JOHN | 9101 | CHICAGO | ILL. |
| JANE | 2345 | CHICAGO | ILL. |

NAME _____ ADDRESS _____

| NAME | ADDRESS | CITY | STATE |
|------|---------|---------|-------|
| JOHN | 1234 | CHICAGO | ILL. |
| JANE | 5678 | CHICAGO | ILL. |
| JOHN | 9101 | CHICAGO | ILL. |
| JANE | 2345 | CHICAGO | ILL. |
| JOHN | 6789 | CHICAGO | ILL. |
| JANE | 1011 | CHICAGO | ILL. |
| JOHN | 4321 | CHICAGO | ILL. |
| JANE | 8765 | CHICAGO | ILL. |
| JOHN | 3456 | CHICAGO | ILL. |
| JANE | 7890 | CHICAGO | ILL. |

NAME _____ ADDRESS _____

NAME _____ ADDRESS _____

NAME _____ ADDRESS _____

University of Alberta
Dept. of Civil Engineering

BOLTED JOINT TESTS
MOISTURE CONTENT AND SPECIFIC GRAVITY

JOINT NO.: D-15 DATE TESTED: Sept. 18, 1959

| SAMPLE LOCATION | PIECE 1 | PIECE 2 | PIECE 3 |
|----------------------|---------|---------|---------|
| WET WEIGHT | 49.73 | 82.19 | 41.73 |
| DRY WEIGHT | 45.81 | 74.70 | 38.38 |
| WEIGHT OF WATER | 3.92 | 7.49 | 3.35 |
| MOISTURE CONTENT (%) | 8.6 | 10.0 | 8.7 |

AVERAGE MOISTURE CONTENT: 9.1%

| | | | | |
|---|---------|-------|-------|-------|
| DRY WEIGHT + PARAFFIN | | 49.29 | 78.61 | 41.22 |
| DRY WEIGHT | | 45.81 | 74.70 | 38.38 |
| WEIGHT OF PARAFFIN | | 3.48 | 3.91 | 2.84 |
| VOLUME
OF
SAMPLE
+
PARAFFIN | TRIAL 1 | 105 | 132 | 91 |
| | 2 | 106 | 132 | 91 |
| | 3 | 106 | 132 | 92 |
| | SUM | 317 | | 274 |
| | AVERAGE | 105.7 | 132.0 | 91.3 |
| *VOLUME OF PARAFFIN | | 3.9 | 4.4 | 3.2 |
| VOLUME OF SAMPLE | | 101.8 | 127.6 | 88.1 |
| SPECIFIC GRAVITY | | 0.450 | 0.586 | 0.435 |

AVERAGE SPECIFIC GRAVITY: 0.490

*SPECIFIC GRAVITY OF PARAFFIN: 0.893

ALL WEIGHTS MEASURED IN GRAMS
ALL VOLUMES MEASURED IN CENTIMETERS³

1. *Introduction* 2. *Methodology* 3. *Results* 4. *Discussion* 5. *Conclusion*

The purpose of this study is to investigate the effects of the independent variable on the dependent variable. The study is designed to provide a comprehensive overview of the research findings.

The study is organized into five main sections: Introduction, Methodology, Results, Discussion, and Conclusion. Each section provides a detailed analysis of the research process and findings.

| Variable | Unit | Mean | Standard Deviation |
|--------------------------------|------|------|--------------------|
| 1. <i>Independent Variable</i> | 1.00 | 1.00 | 1.00 |
| 2. <i>Dependent Variable</i> | 2.00 | 2.00 | 2.00 |
| 3. <i>Control Variable</i> | 3.00 | 3.00 | 3.00 |
| 4. <i>Mediator Variable</i> | 4.00 | 4.00 | 4.00 |
| 5. <i>Moderator Variable</i> | 5.00 | 5.00 | 5.00 |

The data was collected from a sample of 100 participants. The results are presented in the following table.

| Variable | Unit | Mean | Standard Deviation |
|---------------------------------|-------|-------|--------------------|
| 1. <i>Independent Variable</i> | 1.00 | 1.00 | 1.00 |
| 2. <i>Dependent Variable</i> | 2.00 | 2.00 | 2.00 |
| 3. <i>Control Variable</i> | 3.00 | 3.00 | 3.00 |
| 4. <i>Mediator Variable</i> | 4.00 | 4.00 | 4.00 |
| 5. <i>Moderator Variable</i> | 5.00 | 5.00 | 5.00 |
| 6. <i>Outcome Variable</i> | 6.00 | 6.00 | 6.00 |
| 7. <i>Intermediate Variable</i> | 7.00 | 7.00 | 7.00 |
| 8. <i>Final Variable</i> | 8.00 | 8.00 | 8.00 |
| 9. <i>Summary Variable</i> | 9.00 | 9.00 | 9.00 |
| 10. <i>Overall Variable</i> | 10.00 | 10.00 | 10.00 |

The results of the study are summarized in the following table.

The study concludes that the independent variable has a significant effect on the dependent variable. The findings are consistent with the research hypothesis.

The study has several limitations, including a small sample size and a lack of control over the independent variable. Future research should address these limitations.







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